OCTOBER 1957

plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

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CLEPO 166-C ELECTROCLEANER FOR STEEL

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CLEPO 166-C might be likened to a bird dog. It knows how to find the hidden quarry—dirt in out of the way places. With its unusual qualities, this cleaner gets into recesses, holes, corners, back of sections, tube interiors, to loosen the dirt whether oil, grease, emery or other soil material. It removes smut. It rinses freely and clears away loosened dirt from hidden spots. It can be used with either hard or soft water. Generally used as an anodic cleaner at 6 volts, CLEPO 166-C can also be used as a direct electrocleaner.

The next time a CLEPO Field Service man calls, ask him to demonstrate the effectiveness of CLEPO 166-C. Or write us for a trial sample.

Back of *all* CLEPO Formulations and Technical Service is a quarter of a century of close experience with cleaning and finishing problems in the metal working field. Why not avail yourself of this experience?

FREDERICK

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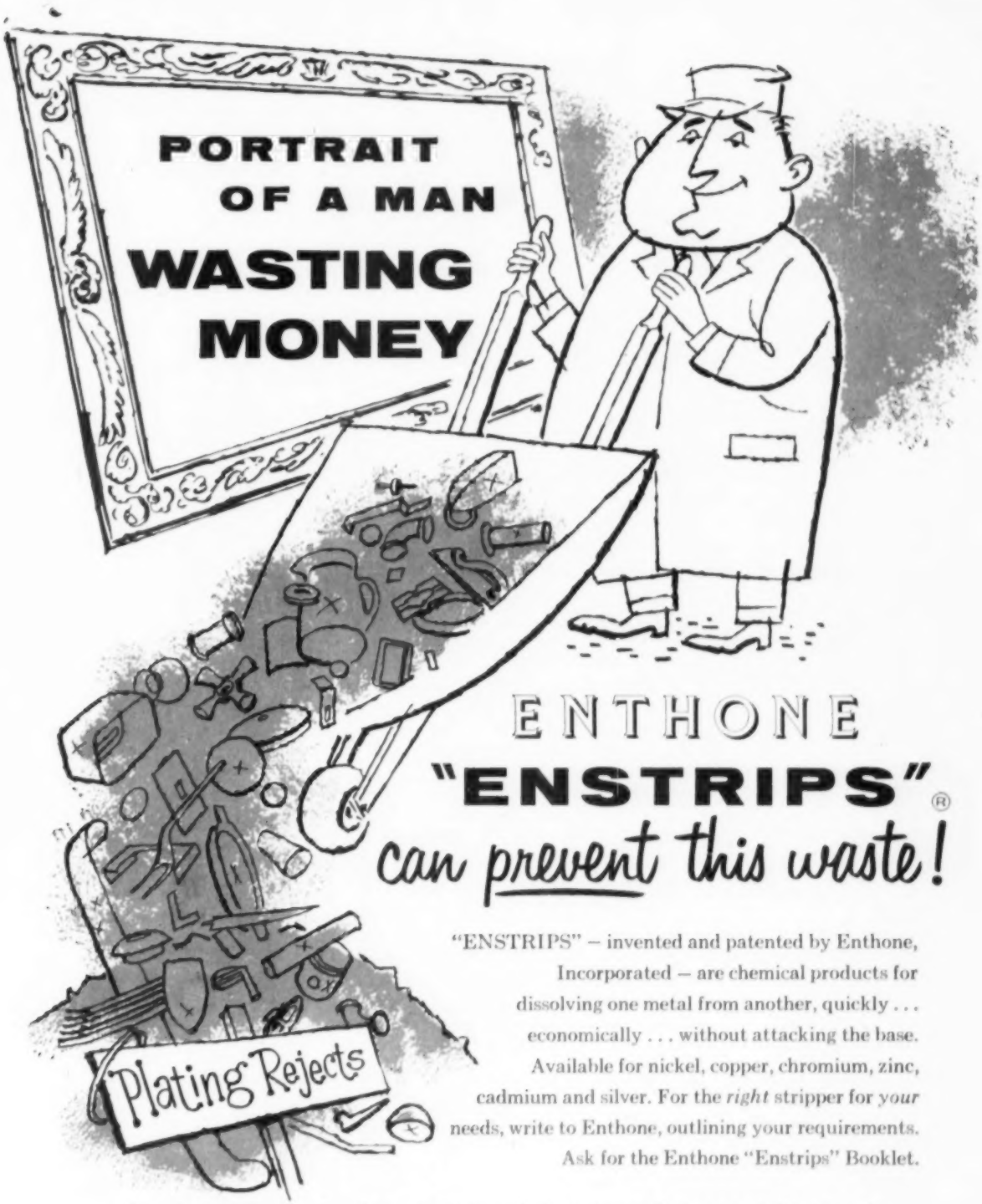

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Metal Finishing Processes • Electroplating Chemicals

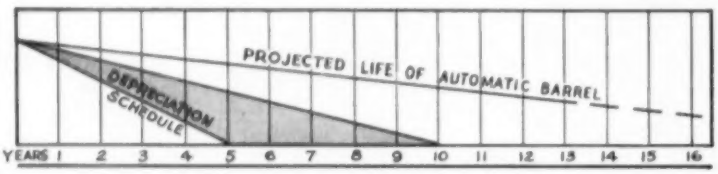
A HOT IDEA FOR COOL PROFITS

THE FINISHING TOUCH

by A. B. HOEFER
Vice-President
FREDERIC B. STEVENS, INC.

Stevens Automatic Plating Barrels Adaptable to Any Situation

IT'S GOOD TO KNOW WHEN YOU ARE INVESTING in a plating machine that Stevens units can be designed so that more than one type of plating can be done on one machine. Also, that changes can be made in the future to meet any specifications you may have. We've changed over a good number of Stevens machines in our time. That's why there are so many Stevens machines in use far beyond their depreciation schedule.



THERE ARE MANY OTHER SAVINGS you can enjoy beyond long life. Stevens Automatic Barrel machines require only one employee to operate the machine. These units are completely automatic, because the open end barrel is loaded when in a vertical mouth-upward position and automatically unloaded by tilting the barrel downward. There are no lids to fasten or unfasten.

POSSIBLE MIXING OF PARTS IS ELIMINATED in the Stevens automatic barrel. Small, special loads can be conveniently run without penalizing the productive capacity of the machine and without the inconvenience of partitioned cylinders. Stevens Automatic Barrel Machines are used for varied processes that include copper strike; copper, nickel, tin, brass, zinc and cadmium plating; phosphating; alrocing; dichromating; cleaning and bright dipping.

THE SIMPLE COMPACT DESIGN of this machine permits production capacities as high as 4,000 pounds per hour. Simplicity of design makes it equally practical to distribute the capacity between two or more machines to provide flexibility in plating thicknesses and production.

Let us give you more details on Stevens Automatic Barrels. Write us today, Frederic B. Stevens, Inc., 1814 Eighteenth Street, Detroit 16, Michigan.

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YOUR METAL FINISHING SUPERMARKET
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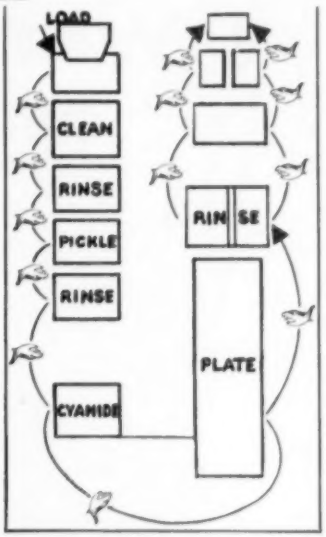
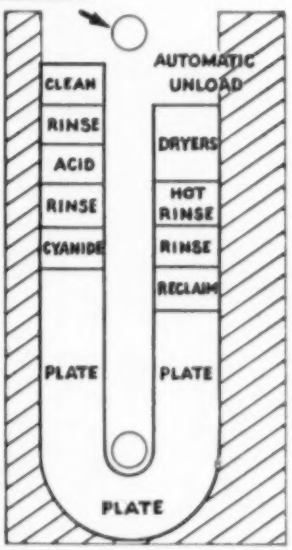
HOW AUTOMATIC BARREL PLATING CAN REDUCE YOUR HANDLING AND BURDEN COSTS—

Compare this
Conventional Horizontal Barrel Line



With this
Stevens Automatic Barrel Installation



Production from *both* installations is the same.

Notice how many more handling steps (indicated by the illustrated hands) and manual load-unload operations (indicated by the arrows) are required for the manual set-up.

Notice, too, how much floor space (indicated by shaded area) is saved with a Stevens automatic installation. No manual operations required with automatic load and unload.

An Educational Society for the Advancement of the Science of Electroplating, the Finishing of Metals and Allied Arts

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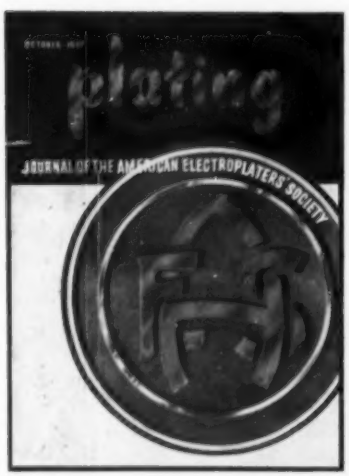

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plating

Journal of the American Electroplaters' Society

October 1957 — **Vol. 44, No. 10**

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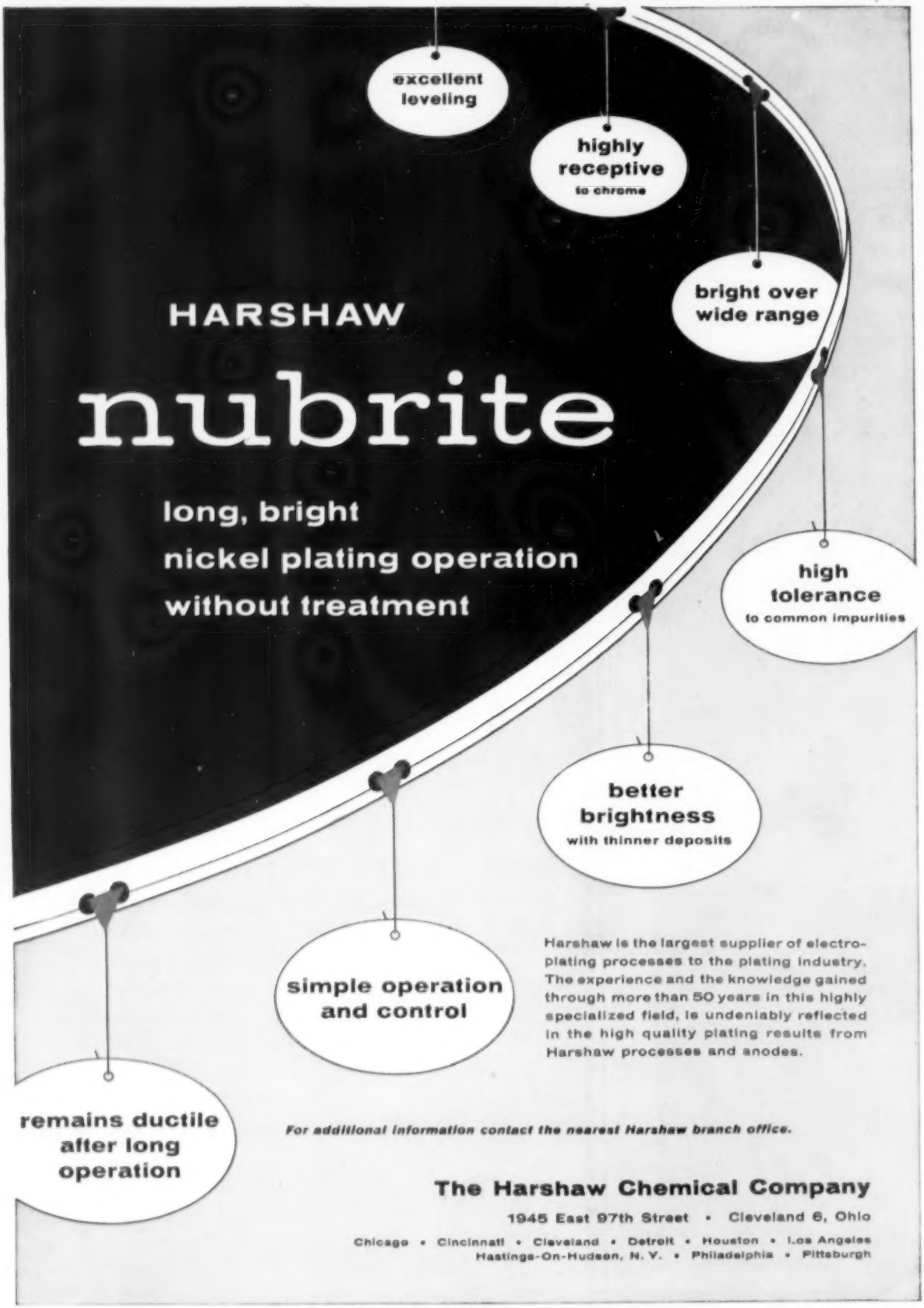
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EDITORIAL

BLUEPRINT FOR YOUR SOCIETY'S FURTHER GROWTH

THE SUPREME SOCIETY, while convened in Montreal, approved an amendment to the Bylaws, setting up a new nine-man Membership Committee which will perpetuate itself by the appointment of three new members each year for respective three year terms.

In past years, it has been the duty of the Second Vice President to assume the title of Membership Chairman and do all possible in one short year to promote membership growth throughout the Society. Under this line of action, about the only part of the program carried over from year to year was the Application Blank and the initiation fee. Each new Second Vice President set about his job in the way he saw best. With the advice of his senior officers, he did all he could to arouse membership consciousness in the officers of each Branch.

Now, with a rotating nine-man committee largely operating under its own Bylaws, the promotional work started this year will not only benefit the Society during the current period but will be carried forward by the committee members who stay on for one or two additional years, and in this way, be developed to the fullest possibility.

Enough dreaming of the bigger and greater AES of the future. How many members in your Branch have not yet paid this year's dues? At the writing of this Editorial, there may be many—but when you read it, there should be none! Secretaries and First Vice Presidents: Have you done all possible to see that the "dropped members" list is kept as low as possible in your Branch?

With this problem handled in the proper manner and your coming year's meeting programs all set up, it is time to start selling the benefits of AES membership to potential members. Start your Branch membership campaign with your first meeting this fall, by having each present member bring a guest who might become a new member. For your assistance, a great many tried and proven methods are set forth in the Branch Officers' Manual in Section IIA on Membership. Use your Branch Officers' Manual and you may be pleasantly surprised at the great help it can be.

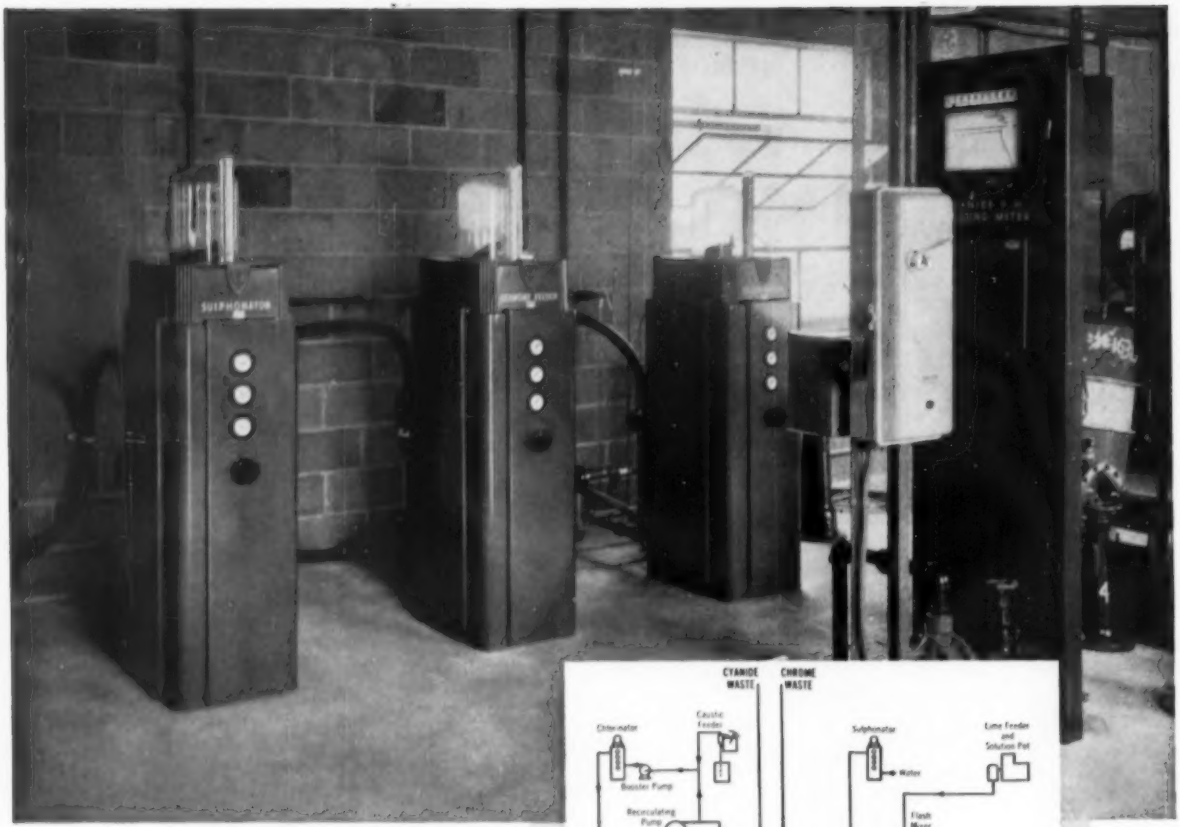
Sustaining Membership promotion, moreover, should not be left entirely to the Research Committee. Each Branch should have a working program for contacting all the companies and corporations within their area, using the data and information supplied by the Research Committee. We would ask you to take another look at the Branch Directory as published in the June 1957 issue of PLATING (page 638.) Are you satisfied with the number of Sustaining Memberships listed under your Branch?

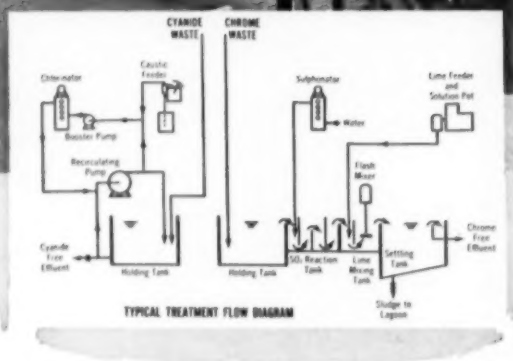
To stand still in membership, in a world progressing as rapidly as ours is today, is to go backward! The only way we can have a bigger and better AES, and pass the benefits of the AES on to others, is to have a pronounced growth in our membership.

Wouldn't it be wonderful if every member signed up a new member during the coming year? Let's try it!

Ralph D. Wysong

Second Vice President





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DAYSTROM INSTRUMENT DIVISION USES

W&T *Cyanide & Chrome Waste Treatment*

The Daystrom Instrument Division of Daystrom, Incorporated, located at Archbald, Pennsylvania, has provided a compact and efficient treating plant to destroy the toxic components of their plating waste. The treatment plant has been in continuous operation since 1953.

The cyanide bearing waste is treated with chlorine and caustic, using a W&T Water Diaphragm Chlorinator and a W&T Chemical Solution Feeder. The treatment breaks down the cyanide to harmless carbon dioxide and nitrogen gas components.

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If you would like more information on Wallace & Tiernan cyanide or chromium waste treatment, write for bulletin RA-2120-CP.

WALLACE & TIERNAN INCORPORATED

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the first new type of filteraid in thirty years

Silicon carryover – negligible – cannot foul the most sensitive plating solution . . . because Nerofil is a carbon-base filteraid. Tests of Nerofil in 50% sodium hydroxide at 125°F showed no silicon solubility in 30 minutes.

No high-temperature breakdown as can happen with cellulosic filteraids . . . and Nerofil costs less!

The fast flowrates of powder filteraids (without the silicon solubility) . . . because Nerofil is an improved *processed* carbon-base filteraid, not merely crushed carbon.

High filtration efficiency . . . Nerofil gives thorough removal of all solids, even microscopic and colloidal, including slimes and sludges. All these advantages have been *proved* in many months continuous use of Nerofil in leading plating plants.

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NEW SHAPED, EXTRUDED APW SILVER ANODES

STANDARD SHAPES

CONTROLLED GRAIN SIZE: **APW EXTRUSION PROCESS*** **controls grain size within definite limits — minimizes sheddings**

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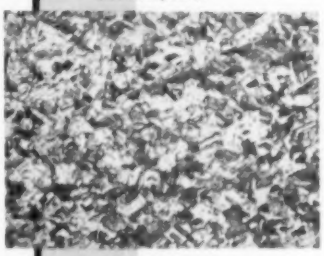
Costs are lowered by prolonged anode life, minimized polarization and less silver scrap to be refined.

In addition, the APW Extrusion Process controls grain size within definite ideal limits so that corrosion is smooth and uniform. Electrodeposits are *consistently* smooth. Shedding is virtually eliminated. Rejects are a comparative rarity!

We are anxious that the silver you buy in anodes is used most efficiently and economically. Special anode shapes will be engineered to meet your particular plating bath conditions. Call or write for a representative. We'll be glad to assist with your plating problems.

*Pat. Pending

ROLLED FLAT PLATE ANODE SECTION:
This Photomicrograph shows highly irregular, uncontrolled grain size—a major cause of shedding and resultant rough electrodeposits.



APW EXTRUDED ANODE SECTION:
Small, fully controlled regularity of grain size promotes uniform corrosion, smoothest electrodeposits, less rejects.

THE AMERICAN PLATINUM WORKS

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BALANCED QUALITY*

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**Outstanding performance and value*

The above illustrations show Miccrosol being used as a coating. At the left, Miccrosol Spray S-2003 is being applied to a large plating tank. At the right, Miccrosol E-1003 has been applied by dipping this large paddle. Contact us for the name of the qualified Miccrosol coater nearest you.

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MIL-ETCH – Etches rapidly at low concentrations; gives uniform, fine-grained etch. No scale or sludge. Long life, simple control, no excessive foam or fumes, nondusty to handle.

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SPRAY-ALTREX – Spray cleans without etching, has new low-foaming detergents. Easy to control, it works well in all kinds of water.

WYANDOTTE 468 – Neutral, solvent-type cleaner. Miscible with either hydrocarbon solvents or water. Removes oil, buffing compounds, drawing compounds without etching.

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WYANDOTTE 2487 – Brightens aluminum alloys that darken in alkaline etching processes. Safer than acids; permits close control of desmutting bath. Easy-to-handle granular form; makes solutions of long life.

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PHOS-IT* – Liquid, phosphoric-acid-type product. Removes heavy corrosion quickly, brightens at the same time. Used diluted with water. For brush or dip application. Has high detergency, rapid action, low use-cost.

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Dependable Wyandotte products give you better results, shorten maintenance time, reduce operating costs. Send for free technical literature on the Wyandotte products designed to fit your aluminum-finishing operations. Or call in a Wyandotte representative, today. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

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444-C – Removes paint from large parts or objects quickly. A thickened product for brush or flow-on stripping. Penetrates multiple coats of finishing materials with one application; is nonflammable, water rinsable.

SUPERSOLVE – Removes hard-to-handle enamels and other finishes quickly, without attacking metal. Used hot, diluted with water. Rinses easily.

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- ☐ Desmutting
- ☐ Brightening
- ☐ Barrel Finishing
- ☐ Deoxidizing
- ☐ Paint Preparation
- ☐ Paint Stripping

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Firm _____

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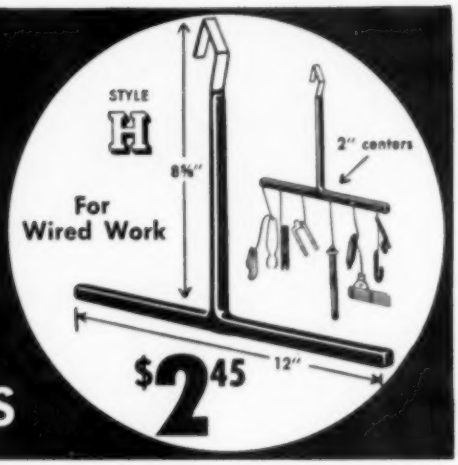
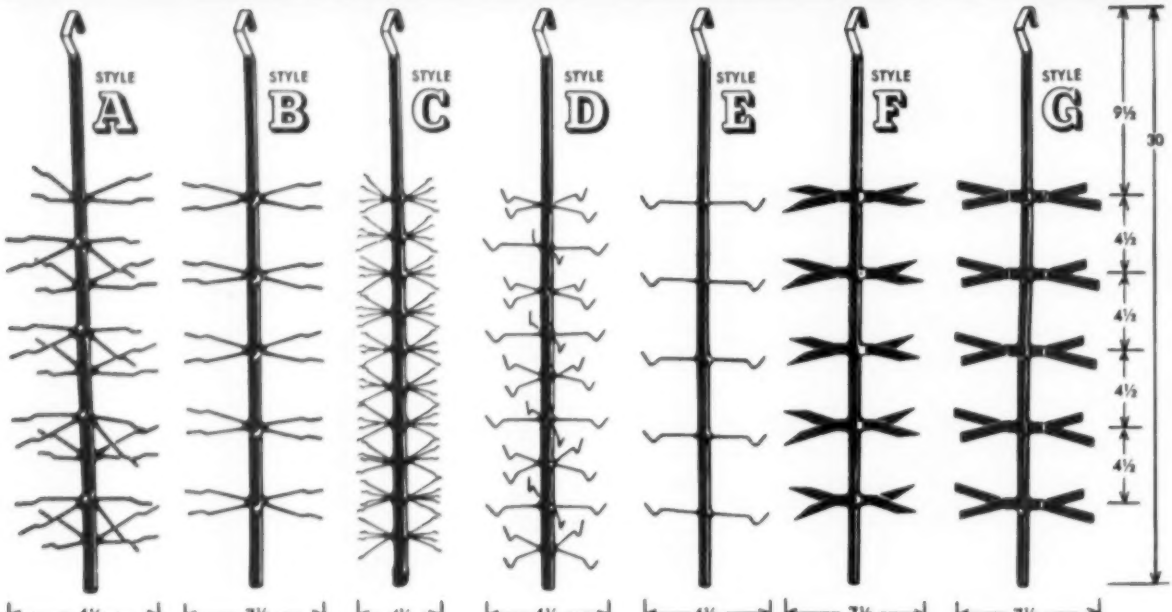
New, Ready Made Mass-produced *Economy* Plating Racks





Style A	Style B	Style C	Style D	Style E	Style F	Style G
Tips .114 dia. phosphor bronze	Tips .114 dia. phosphor bronze	Tips 1/16" dia. phosphor bronze	Tips 3/32" dia. phosphor bronze	Tips 3/32" dia. phosphor bronze	Tips 1/16x1/2" phosphor bronze	Tips 1/16x1/2" phosphor bronze
$5.78	$4.77	$6.00	$5.83	$4.42	$5.84	$5.69

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SPINES are one-piece solid copper, round cornered and sand-blasted for perfect adhesion of the insulation.

RIGID CONSTRUCTION. The phosphor bronze tips are riveted to the spine, then soldered where necessary for complete rigidity. **Do not confuse with Thinker Boy construction—the tips are not replaceable.**

COATED AFTER ASSEMBLY with the same Universal Plastic used on BELKE Custom-Built and Thinker Boy Racks—withstand all cleaning and plating cycles.

The low prices are made possible through economies of mass production. No specifications can be changed at these prices except in mass production quantities. Prices subject to change with changes in costs.

Place your order early

Economy Racks will be stocked for immediate shipment as soon as production catches up with the demand. In the meantime please order in advance of your requirements and avoid disappointment.

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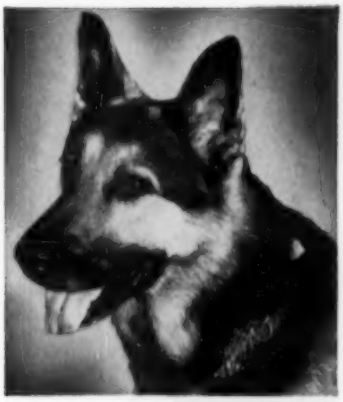
EVERYTHING FOR PLATING PLANTS

A Timely Message on

Choosing A Career



That's Me!

by Sox von Liebestraum Sax
Ex Detroit Rep. and Assistant to
Ben P. Sax, Chairman of the Board
American Buff Company

It isn't often a dog ends up with my position, responsibility and supply of dog biscuits. It's all in how the bones bounce. Though, my sire, Champion Zarek von Liebestraum, vitally influenced my career choice.

Dear old Dad took me aside one day and filled me in on the "Birds and the Buffs." Long before American Buff was No. 1 in the industry, he said that there was a firm that was going to have the world by the buff sooner than later.

Heredity was "on my side," too. My fine old bloodline runs back so far it runs off the family tree. That's more than most dogs, or other German Shepherds for that matter, can say.

My final coup was adopting Stan Sax, our Sales Manager. After considerable training on my part, he's now a model master.

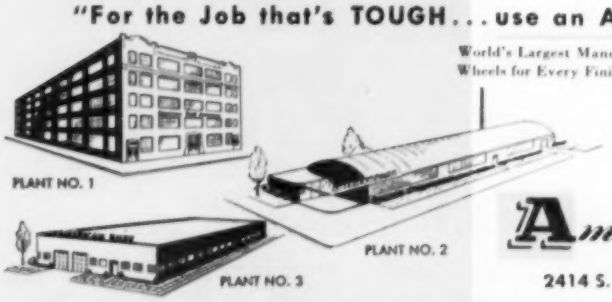
Choosing a career isn't half so easy as choosing the best Buffs on the market—American.

Cordially,

Sox von Liebestraum Sax

"For the Job that's TOUGH... use an AMERICAN BUFF"

World's Largest Manufacturer of Buffs and Polishing Wheels for Every Finishing Operation



PATENTED CENTERLESS OR PERMANENT CENTER CONSTRUCTION

American Buff Company

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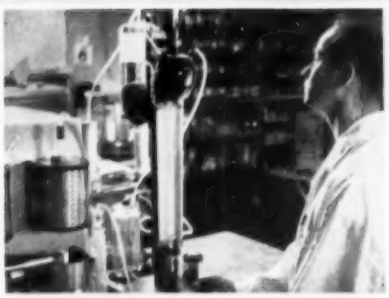
"Al, you must be crazy . . ."

"A few years ago we decided to make our Quality Control Lab as good as could be found anywhere. We staffed it with first rate people and bought the latest in equipment including the finest Spectrographic Instrument available. At this point, our accountant — you know the type — a nice enough guy, but never happy unless he's shaking his head and wiggling his fingers at you . . . said to me, 'Al, you must be crazy, putting all this money into Quality Control.'

"Well, it took a lot of doing—and plenty of dollars, but it was worth it. We've grown steadily and it sure is a nice feeling to know that many of our regular customers include the finest platers in the country."

Al Kerzner

AL KERZNER, *President*



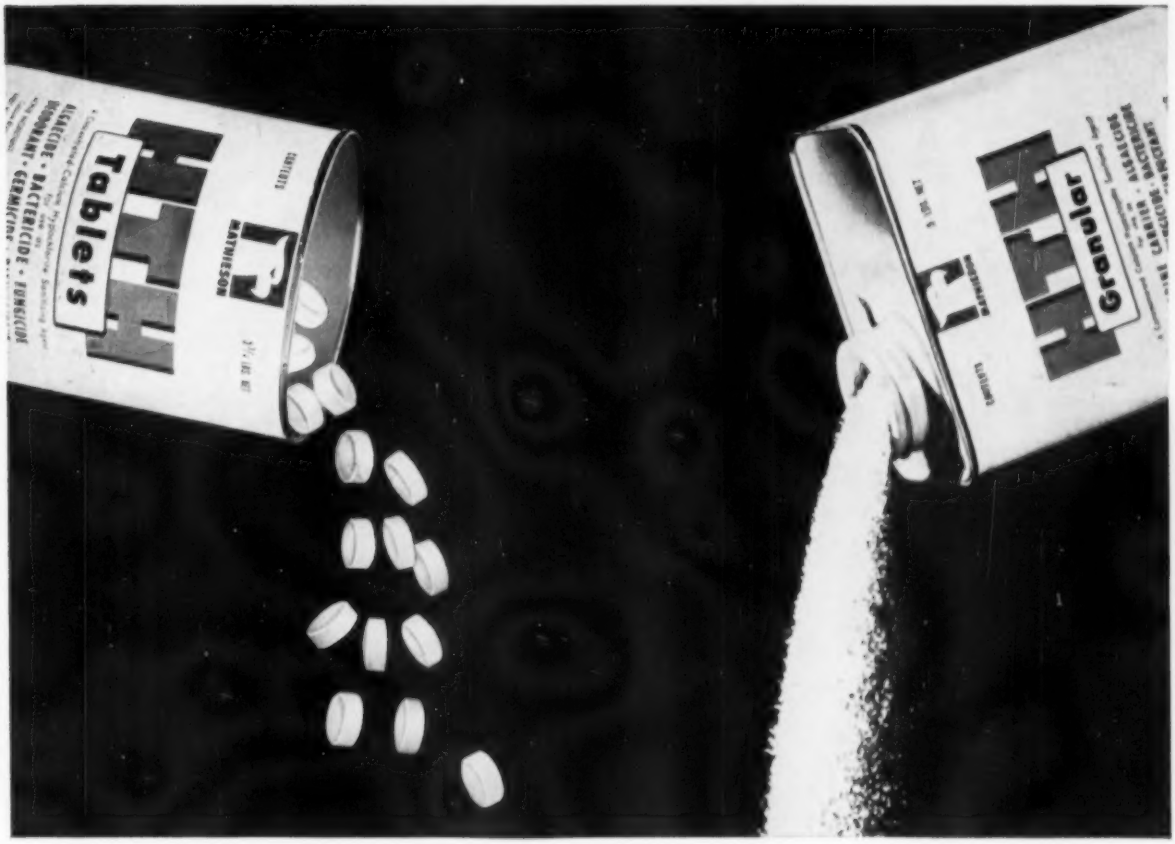
Illustrated are several views of our all new Wet and Spectrographic Laboratories, including some of the finest quality control equipment available.

If you're a user of Copper, Nickel or Zinc Anodes, and if quality (at a competitive price) is an important factor to you, contact us! We manufacture them in a variety of sizes and shapes, and we can make them to your specifications.

NEW JERSEY METALS COMPANY 722 Rockefeller St., Elizabeth 2, N. J.

Serving Industry from Coast to Coast — since 1920

ELizabeth 4-6336



Neutralize dangerous cyanide waste with "dry" chlorine . . . HTH

Chlorine products are winning wide acceptance in the treatment of cyanide waste. And of all chlorine products, none is more effective, convenient, and economical than HTH.

EFFECTIVE . . . because HTH goes to work immediately, releasing the hypochlorite solution that quickly converts cyanide to relatively harmless cyanate.

CONVENIENT . . . because HTH is chlorine in *dry* form, it can be added directly to waste solutions. It's perfectly safe and simple to store, use and handle at all times.

ECONOMICAL . . . because with HTH you need no costly equipment, no technically trained personnel. You eliminate the use of carboys and the breakage, spilling and waste that frequently occur.

HTH comes in two forms. **HTH Granular**—***non-dusty, free-flowing and fast-dissolving—is packed in 100-lb. drums and in cases of nine 5-lb. cans.*** **HTH Tablets**—***a slow, steady source of chlorine over longer periods—are packed in 100-lb. drums and in cases of twelve 3¾-lb. cans.***

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4950

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- No costly overhaul or rebuilding is required for cycle changing on this *most versatile of all automatics*. Only the positions of pick-up heads need be moved, plus minor tank partition changes.
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- Because no elevating mechanism operates above rack carrier unusually low headroom is needed.
- Self-cleaning heavy duty contacts have positive 6-point connection . . . practically no attention is required.
- Tank surfaces are left clear by easily removable rack carriers . . . an advantage in servicing and in manual plating of large pieces.
- Automatic loading and unloading of parts from standard double-spine racks is available.
- Where conversion coatings and bright dips are used, a delayed set-down arrangement can be furnished to work automatically with the cycle.
- Where more than one cycle is required, machine can be made to include by-passing.

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Hydraulic operation, standard; pneumatic operation, optional.

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Send brochure on new fully automatic Cycleflex.

Company .....

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ROHCO 503 resists breakdown at high temperature, giving peak economy of operation—generally 50,000 or more ampere-hours per gallon.

BRIGHTNESS

Uniformly high luster, from high current densities into the deepest recesses.

COVERING POWER

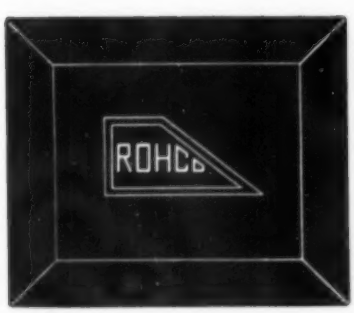
Helps coverage in deep recesses or on high carbon steels.

FINE GRAIN

For maximum luster, corrosion resistance, and acceptance of chromate conversion coatings or black finishes.

ROHCO 503 is a balanced liquid formulation that has been tried and proven in 150,000 gallons of zinc solution. Remember, ROHCO analytical service and technical representatives are available for assisting you in conversion or any other plating problems. Send coupon for further details!

R. O. HULL & COMPANY, INC., 1302 Parsons Ct., Rocky River 16, Ohio



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Yes, send FREE, ONE QUART TRIAL OFFER of RINS-AID! No obligation, whatsoever.

Name..... Title.....

Company.....

Street Address.....

City..... Zone..... State.....

Facts to consider when you're buying

Chromate Conversion Coatings

for Corrosion Protection, Paint Base, Decorative Finishing

WHAT IS IRIDITE®?

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002" max.) gel-like, complex chromate film of a nonporous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

If your company is manufacturing or buying parts or complete assemblies made from or plated with any of the more common non-ferrous metals—zinc, cadmium, aluminum, magnesium, silver, copper, brass or bronze—you've probably already run up against the question of finishing these surfaces with a chromate conversion coating. These coatings are used to protect against corrosion, or to provide a base for paint or to provide a decorative finish for sales appeal or shelf life. Since chromate conversion coatings represent a relatively new means of obtaining these finishes, this digest of facts to consider may be of value to you.

1. THE COATINGS THEMSELVES. There are many brands on the market. All are similar in many ways. Each, of course, offers its own specific advantages and these may relate to operating techniques, performance under actual use conditions, cost, availability, etc. Naturally, you'll want to choose a coating that is widely known and accepted under both military and civilian specifications.

2. THE COMPANY BEHIND THE PRODUCT. Is it a reliable, established organization? Does it offer experienced technical service, both from the field-engineering organization as well as the home office and laboratories? The man who sells and services your installation should be thoroughly familiar with not only chromate conversion coatings and their applications, but also with the characteristics and performance of related finishing operations such as precleaning, electroplating, painting, etc. This is most important since all steps of the finishing cycle must be functioning properly for the satisfactory performance of the ultimate finish produced.

3. AVAILABILITY OF THE PRODUCT. Ideally, of course, the material should be readily available to you from nearby warehouses to avoid time loss in long distance shipping and to provide emergency service, should the need arise.

4. COST. Naturally, the initial price of the material is important to you. However, just as you consider ultimate cost when you are buying mechanical equipment, ultimate cost must be considered for these finishing chemicals. So, it will pay you to investigate consumption costs, labor costs and the other factors which go into the determination of ultimate cost. Further, cost alone gives no indication of product performance, so careful attention must be given to the purpose the finish must serve and the value that finish will add to your product.

5. FACILITIES FOR RESEARCH AND DEVELOPMENT. Perhaps the existing types of chromate conversion coatings do not include a compound that will accomplish exactly what you wish. Then, it is important to deal with a supplier who has adequate research and development facilities available to work with you to produce a material to meet your needs. Naturally, such a project is seldom completed overnight. But, with complete cooperation and confidence from both you and your supplier, chances are a satisfactory program can be completed.

These are the concepts of sales and service on which we, Allied Research Products, Incorporated, have developed and marketed the line of Iridite chromate conversion coatings . . . superior product performance, complete sales and technical service, easy product availability, economical cost, extensive research and development facilities. No doubt you are familiar with our line and have seen this trademark—

IRIDITE®

—in our advertising, technical literature or on shipping containers in your plant. Remember this trademark when you're buying or investigating chromate conversion coatings for your company. It's your assurance of quality, economical products from a reliable and established company, skilled sales and technical service from both our home office and a national network of representatives, immediate availability from warehouses in strategic industrial areas and our willingness to work with you to develop new finishes to meet your needs, should the present line fall short.

For complete information on Iridite chromate conversion coatings, write today for your free copy of our technical data file. Or, for immediate advice, call in your Allied Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

ALLIED RESEARCH PRODUCTS
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Manufacturers of Iridite chromate conversion coatings for corrosion resistance, paint systems, final finishing of non-ferrous metals; ARP Plating Brightener & Chemicals. West Coast Licensee—L. H. Butcher Co.

SPEEDS THE **UNDERWOOD** WORLD'S BUSINESS

discovers KENVERT® 17A

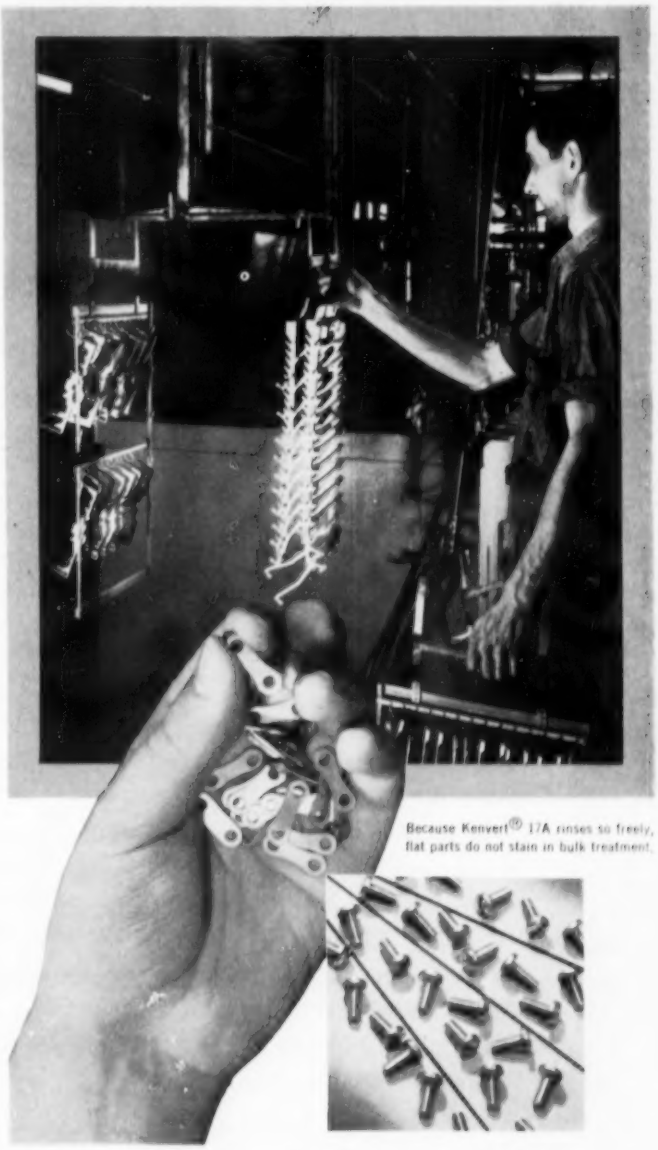
A bright new star has appeared in the chemical conversion coatings field. Only two years old—the Conversion Chemical Corporation has made tremendous strides in the development of new coatings that achieve maximum corrosion protection and brightness.

Underwood made their own bright dip for many years to insure high quality standards and substantial savings over products commercially available to them. Twenty-four hour salt spray corrosion protection as well as bright appearance is required by Underwood Laboratories for this application.

It came to the attention of Underwood Engineers that a product called Kenvert® 17A was reputed to show savings that were almost unbelievable while maintaining necessary high quality standards. Kenvert® 17A was evaluated in the laboratory, approved, and placed in production. Savings over Underwood's solution are now 68½%.

> On bulk work, chrome appearance, together with excellent corrosion protection has allowed Underwood to switch screw products from expensive nickel and chrome to zinc and Kenvert® 17A—the process of racking which was formerly required for many of these parts has been eliminated.

Due to the fact that the Conversion Chemical Corporation product line is complete in the chromating field, it has been able to satisfy many Underwood requirements in other applications such as: Kenvert® 32 for non-spotting or staining of brass hardware for carrying cases and Kenvert® 40 which is now used to replace anodizing with equivalent corrosion protection at substantial savings.



Because Kenvert® 17A rinses so freely, flat parts do not stain in bulk treatment.

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CONVERSION CHEMICAL CORPORATION
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Please send information on KENVERT® 17A ☐ 32 ☐ 40 ☐

or other applications _____ to:

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COMPANY _____ TITLE _____

STREET _____

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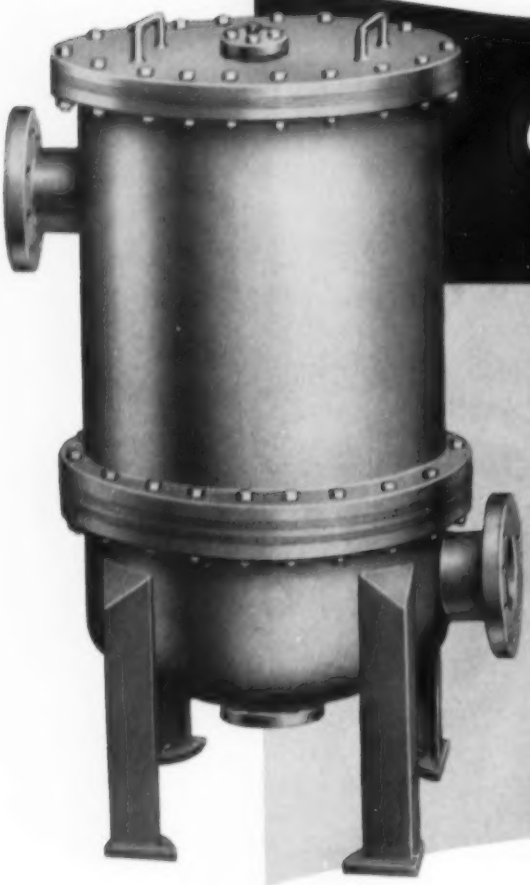

Fulflo FILTERS

clarify any size tank . . . two or even three times per hour

For flawless plating with minimum rejects, Fulflo Filters provide micronic clarification of tanks up to *three times per hour*. Impurities are removed as fast as they are formed or introduced. Agitation is automatically increased.

Fulflo Filters use genuine Honeycomb Filter Tubes in a full range of densities for any degree of micro-clarity. Models are available using 1 to 142 tubes. One 10-inch tube will filter 100 gallons per hour, at low pressure drop. Tube life averages three to six weeks — often up to eight weeks.

Rubber-lined or stainless steel containers are available for solutions of high *p*H; plain steel for cyanide solutions.

Compact size allows for installation on individual tanks, even where space is limited. No filter aids are necessary.

For technical literature or engineering assistance, write Department PL.

Micro-Fine Filtration for Low Cost Clarity

COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC-CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
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AUTOMATIC TUBULAR CONVEYORS • COOLANT CLARIFIERS

Coming soon... More H_2O_2 for a Growing Industry

A new Shell Chemical plant—soon to be on stream at Norco, Louisiana—will help fill the requirements of the rapidly expanding H_2O_2 market. This important new source represents a considerable increase in the national capacity, timed to coincide with expanding developments in hydrogen peroxide chemistry.

In addition to its time-honored application as a textile and pulp bleach, H_2O_2 is finding increasing uses in chemical oxidation, epoxidation and as a chemical intermediate.

To assist you in using hydrogen peroxide, Shell Chemical offers to share its technical experience. Laboratory facilities and a field staff are at your disposal. As a major consumer of hydrogen peroxide, Shell Chemical also can assist you with storage and handling problems.

Your Shell Chemical representative will be glad to consult with you on your H_2O_2 problems. Write to:

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SHELL

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convenience . . .
and economy . . .

Du Pont CYANOBRIK® sodium cyanide is packed in easy-to-open, reclosable drums

Just a few twists of a wrench unlock the full-open-head drums used to ship Du Pont Cyanobrik† sodium cyanide. Yet you can always count on receiving a dry, uncontaminated shipment because the air-tight drum prevents moisture pickup en route . . . and is reclosable for full protection of partially used contents during storage.

Du Pont "Cyanobrik" has a negligible sulfide content—0.0005% or less by specification . . . making it most suitable for use in sulfide-sensitive plating processes.

You can count on prompt on-the-spot deliveries of high-test "Cyanobrik" from a dependable domestic source of supply. And, remember, our technical experts are always ready to give you assistance with any plating problem. Just contact your Du Pont distributor or get in touch with us at the address below.

DU PONT

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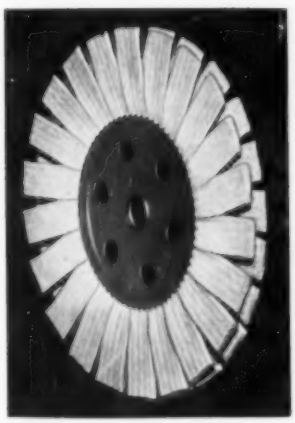
Everything for Plating and Polishing

KUL-KUT BUFFS

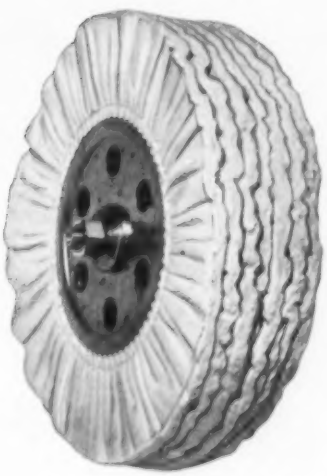
BIAS TYPE • STEEL CENTER • FULLY VENTILATED

Particularly adaptable to semi and full automatic operation



KUL-KUT Segment Buff
(cloth or Sisal)
for polishing
and/or buffing
parts having contoured
surfaces

Longer life—
More parts buffed with
less compound
Fully ventilated and
cooler operating
Pre-tested, accurately
balanced & ready faced
For added safety—one
row of extra heavy
concentric sewing close
to center plate



KUL-KUT Sisal Buff
for cut and color
in one operation
on plain or
stainless
steel

A complete line of air-cooled bias type buffs for every need
Additional information and prices will be supplied on request—a trial will
prove conclusively that KUL-KUT BUFFS are the most economical to use
BUFFING COMPOUNDS EXTRUDED ANY SIZE TO FIT YOUR APPLICATION

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copper plating costs shouldn't be that high!

Westinghouse can help cut those copper plating costs with . . .

WES-X® 100C . . . an *inorganic* compound for cyanide copper baths that doesn't break down at high temperatures. Permits air agitation.

WES-X 102 . . . an *inorganic* compound for use with the above when very high-current densities are required.

WES-X 150 . . . a carbonate remover for any cyanide process. One ounce removes one ounce of carbonate, yields one ounce of free cyanide!

WES-X 310 . . . an organic brightener for acid copper baths that permits higher current density. Bright range from 2 to 200 asf!

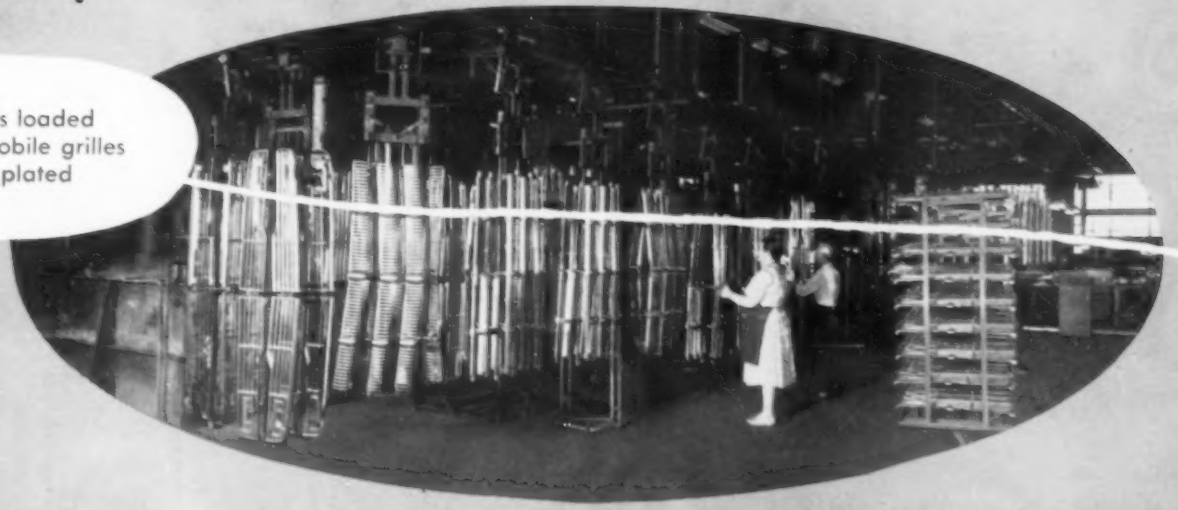
WES-X 313 . . . an acid copper agent for electroforming and other heavy build-up applications.

PERIODIC REVERSE PROCESS . . . for cyanide copper plating produces full bright, leveled, corrosion-resistant deposits. Licenses are available under this patented process.

New Bulletin No. 20-961 includes complete details. Write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-15000

YOU CAN BE SURE...IF IT'S Westinghouse

Every 57 Seconds



A rack is loaded with automobile grilles to be plated

The Udylite Plating Machine at the Jackson, Michigan plant of Ryerson & Haynes, Inc., is fully automatic with automatic rack handling as an integral part of the machine.

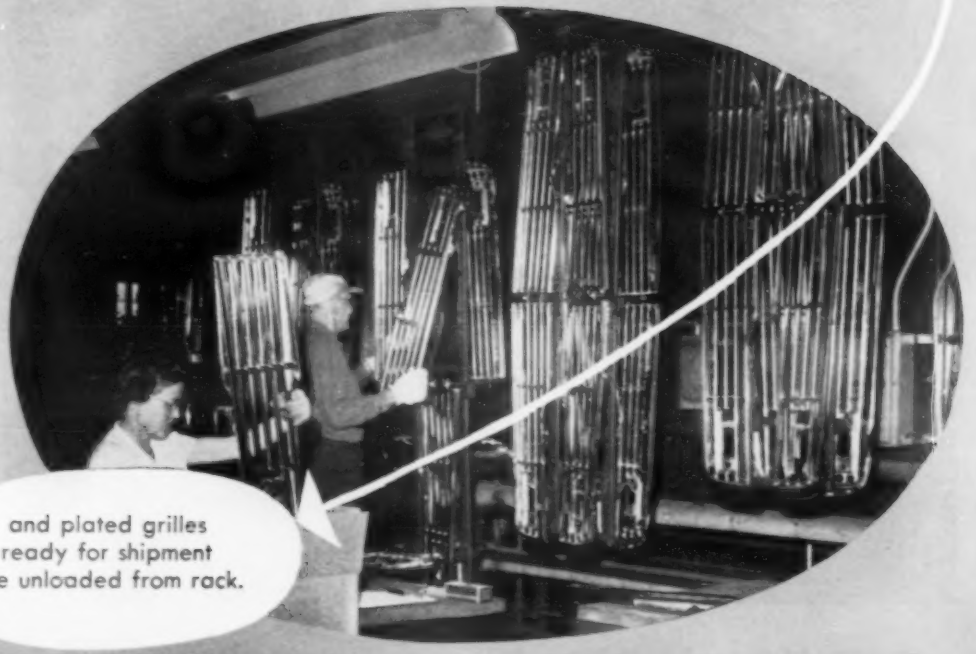
The racks, loaded with grilles to be plated, automatically move from the plant conveyor to the Udylite machine to start the twenty step cycle of precision nickel and chrome plating.

Then, after the processing cycle is completed, racks of plated grilles move automatically from the Udylite Plating Machine onto the plant conveyor and into the packaging and shipping department.

With automatic rack handling, chance of damage and human error are reduced to a seemingly impossible minimum. This is particularly important after nickel-chrome plating, when the grilles carry an investment of plating time and materials.

Ryerson & Haynes, Inc. have enjoyed the benefits of this Udylite machine since January of 1955. Production has been constant, two or three shifts a day, five to seven days a week.

You, too, can lower costs and reduce rejects with Udylite production plating and automatic handling equipment. Write us today.

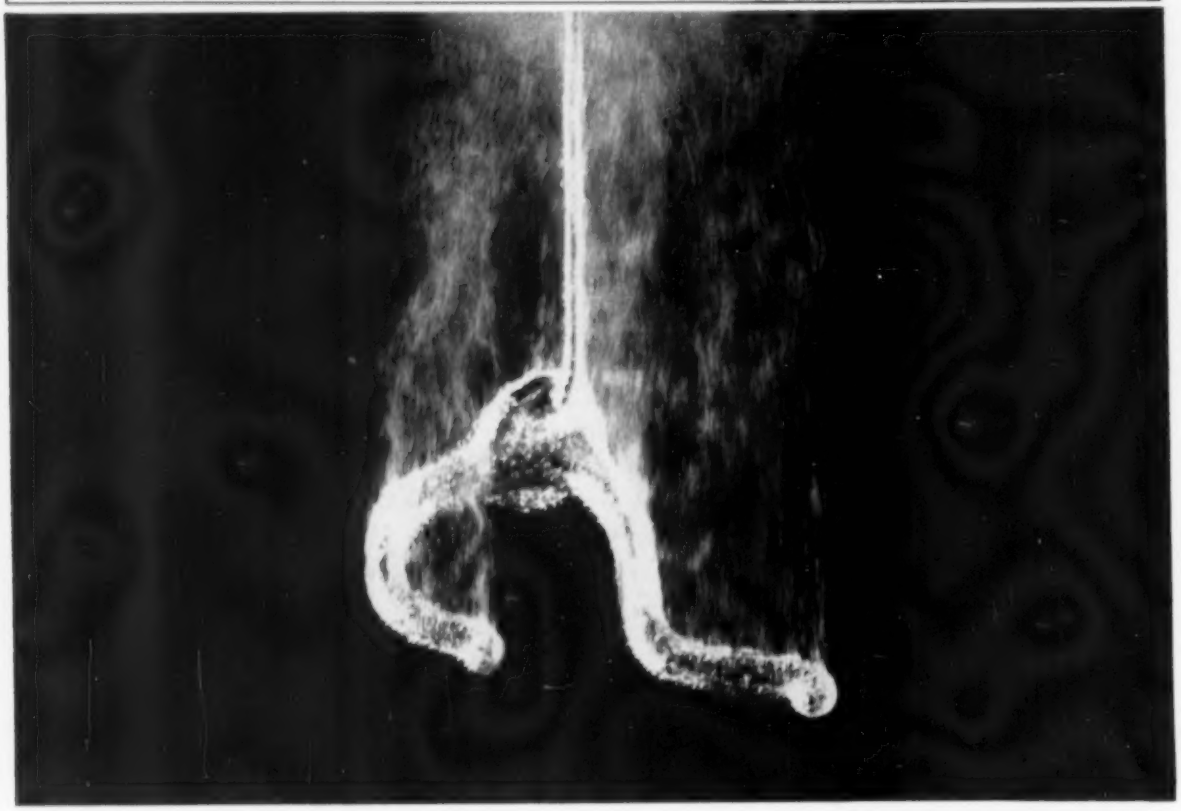


and plated grilles ready for shipment are unloaded from rack.

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST PLATING SUPPLIER

REPORT NO. 2 / ON LOWERING TODAY'S COST OF PRODUCTION



Improved electrocleaning of recesses and low current density areas

Controlling foam, lengthening solution life

Despite careful racking and well-planned production, deep recesses and places of normally low current density on intricately shaped parts are always trouble spots.

Diversey electrocleaners were specially fortified with exceptionally high wetting and emulsifying powers to do an effective job at those "problem places." This chemical cleaning supplements high current carrying capacities to give more efficient cleaning in a shorter time. Work emerges waterbreak-free and smut-free, ready for subsequent baths.

You can also depend on Diversey electrocleaner solutions for longer-lasting cleaning power. Greater contamination capacity enables you to use solutions long after ordinary solutions have to be dumped because of heavy soil accumulations.

Controlled foaming is an added safety feature of Diversey electrocleaning. The limited foam blanket serves as a safeguard against explosion dangers even in those occasional cases where current density is stepped up to speed production. When used according to recommendations, Diversey electrocleaners operate safely through a wide range of current densities . . . always exhibiting a high, stable conductivity.

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PLANTS IN CHICAGO, NEWARK AND SOUTH GATE, CALIFORNIA. WAREHOUSES IN PRINCIPAL CITIES.

DIVERSEY.® **ELECTROCLEANING** ®

(Photo courtesy of Chromium Corporation of America)

Reduce rejects—plate with Mutual low-sulfate chromic acid

When you chromium plate components like these cylinder liners for big diesels you can't risk a reject tag because the job didn't meet specifications.

One form of insurance against plating difficulties is MUTUAL Chromic Acid. Every drum is sampled and analyzed before shipment to make sure that it has a minimum assay of 99.75 per cent CrO_3, and that its sulfate content never exceeds 0.1 per cent.

Rigid quality control in the manufacture of MUTUAL Chromic Acid guarantees the uniformity of the product, making it easier for the plater to accurately control the chromic acid-sulfate ratio of his plating bath.

Mutual Chromium Chemicals

MUTUAL

Sodium Bichromate
Sodium Chromate
Chromic Acid

Potassium Bichromate
Potassium Chromate
Ammonium Bichromate

MUTUAL CHROMIUM CHEMICALS
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Please send:

- ☐ Bulletin 52 – Chromium Chemicals – Their History, Properties and Uses.
- ☐ Bulletin 13 – Anodizing Aluminum by The Chromic Acid Process.

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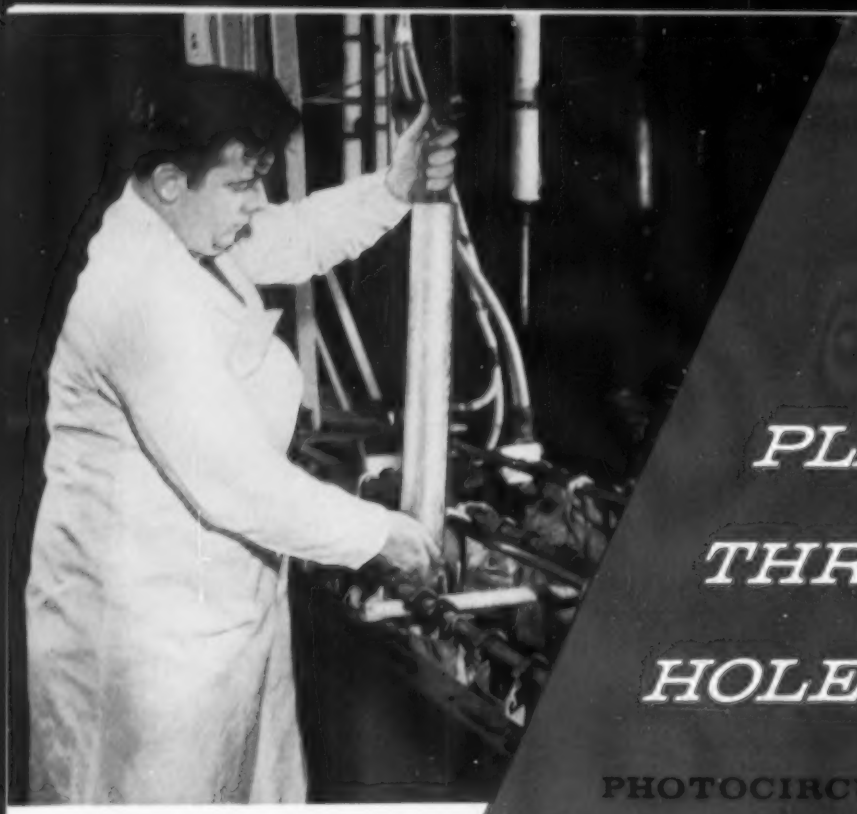
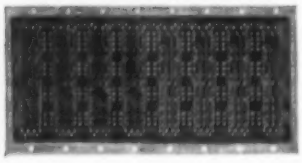
P2-8-1

PLATING PROBLEMS
IN INDUSTRY — NO. 1



PLATING THROUGH HOLES

PHOTOCIRCUITS CORP. USES OFHC® COPPER ANODES TO CUT FIELD REJECTS BELOW 0.01%



Printed circuits consist of electrically conductive patterns bonded to an insulator base. They are widely used to cut down the miles of hand wiring and hand soldering of wires and components in the electronics and avionics industries. For plated-through holes in printed circuits, Photocircuits deposits 0.002-inch copper followed by approximately 0.001-inch solder or 0.0005-inch silver.

Plated-through holes make the best electrical connections between two sides of a printed-circuit board—if there is *uniform plating coverage* of the hole. That's why Photocircuits Corporation, a major designer-manufacturer of printed circuits, copper-plates *exclusively* with OFHC Brand Copper Anodes.

Photocircuits plating men found that conventional copper anodes require costly techniques for uniformly plated-through holes. But with OFHC Copper Anodes, accelerated and simplified procedures became feasible—with such good results that rejects for plated-hole failure in the field are now less than 1 in 10,000.

OFHC Copper Anodes give more uniform plating because OFHC Copper—produced exclusively by AMCO—is free of anode impurities. OFHC Copper is 99.99% pure, contains no oxides, no deoxidants.

To find out how the extreme purity of OFHC Copper Anodes can benefit your own electroplating operation, contact your distributor or our nearest office directly.

THE AMERICAN METAL CO., LTD.

61 Broadway, New York 6, N. Y.

BOSTON — CHICAGO — DETROIT — LOS ANGELES

INDICATE A 1625

THE PLATER'S ART IN PRINTED CIRCUITRY

by NELSON FORAN*

I. INTRODUCTION

ABOUT A HALF DOZEN YEARS ago the printed circuit was born, and now, like any six-year-old youngster ready to enter school, the printed circuit is about to take a seat in the classroom of industry. There is much to be learned—better materials to be found, improved processes and methods worked out, special chemicals developed and most important, the "know-how" of the plater exploited.

Bookshelves bulge with technical literature on the broad subject of electroplating, but even a clear understanding of the basic principles underlying the science of electroplating is merely the starting point to the printed circuit plater, who must also understand the complexities of the many grades and types of materials comprising the laminates—the copper foils, phenolics, epoxies, melamines and special resins and plasticizers; the adhesives, photo-resists, screening and offset printing inks, and the many special operating conditions to suit a given set of circumstances. The answers are not found in books—there is no literary medicine for the ulcers and headaches of trial and error which still seems to be the only way to find the right way.

Bear in mind that, despite its tender years, the printed circuit has already created a complete metamorphosis in the electronic industry, in the thinking and planning of design engineers, and it can be safely predicted that this young giant will soon be used in every conceivable product where the guiding path of an electric impulse is a factor.

The key to the development of new fields for printed circuits lies in the ability of the plater to overcome the limitations of a plain copper circuit by applying coatings of other metals of desired characteristics and properties. In this paper, the methods, requirements and problems of electroplating the printed circuit will be discussed.

II. PRINTED CIRCUIT MATERIAL

Description. With few exceptions, a printed circuit is made from a copper clad board which is composed of a sheet of copper foil, usually 1.4 to 2.8 mils thick, bonded by an adhesive to one or both sides of a laminated plastic insulating board of appropriate thickness, usually within the range of $^1/_{64}$ to $^1/_8$ in. The plastic material of most common usage is made from a phenolic resin impregnated paper base called "phenolic" and the epoxy resin impregnated glass cloth, called "epoxy." There are, however, many more types of plastics used for printed circuit material, each with special properties and designed for specific applications.

The plater must have some knowledge of all these materials and an awareness of the properties that will be affected or changed in the plating process. Resistance to various acids, cyanides, hot alkaline cleaners, solvents, temperature, degree of absorption, are some of the properties of laminates about which a responsible plater must know or investigate before processing.

Choice of Material. Unfortunately, the plater rarely has the opportunity of selecting the laminate exhibiting the best characteristics from a standpoint of ease of processing through the plating shop. Design and manufacturing engineers, however, are beginning to realize that the ultimate success of the circuit often lies in the hands of the plater, and thus laminated sheets of known hazard to the plater are being avoided whenever a deviation from specification can be obtained or a suitable substitution found.

Copper Foil. Obviously, porous copper foil is very undesirable, but most copper foil is porous to a degree, allowing adhesives and resins to be squeezed through the pores during the pressing and curing of the lay-up in the laminating press, producing transparent specks of unwettable, non-conductive resin on the copper surface. This results in pitted plating and actual holes in cases where the plating must act as the protective etch resist, because the oxidizing chemicals in the etchant are thus permitted to penetrate through the pores and undermine the copper right down to the plastic.

Some manufacturers use a copper-clad mold release material to prevent sticking of the press platen to the copper foil during lamination. Residual products are thus baked to the copper surface and though transparent, are nevertheless present and difficult to remove.

Copper clad laminates are shipped in large stocksize sheets, usually 36 by 36 in. or 36 by 42 in., and quite often the manufacturer applies a protective film to the copper foil to prevent oxidation and discoloration during storage and shipping. This is not a serious problem when the circuit manufacturer's process calls for straight printing and etching, but when the circuit must be plated, a rather severe cleaning cycle must be employed, notwithstanding the limitations imposed by the resist and the quality of relatively thin copper foil. Poor adhesion will, of course, result from inadequate cleaning of the copper surface, but too often this is not evident until after a costly gold or rhodium coating has been applied.

Adhesives. In addition to the difficulty associated with the quality and proprietary finishes of copper foil as produced by the various manufacturers, the adhesive bonding the copper to the plastics is often affected by alkaline cleaners and cyanide plating baths to the extent that the circuitry may be readily lifted from the insulating board after only a short cycle in this type bath. The insulating material itself is extremely susceptible to degradation by many plating process solutions, and will be discussed in conjunction with plating an etched circuit a little later.

Inspection. At this point, the obvious question is: Why not inspect the copper clad laminate material as shipped and so avoid at least the problems arising from inferior, off-spec material? Well, the truth of the matter

*Project Engineer, Plating Research & Development Division, Photocircuits Corporation, Glen Cove, New York.

is that in spite of the rigid and costly inspection methods employed at the consumer's plant where standard procedures for checking bond strength, electrical properties, physical dimensions, fabricating qualities, etc. are strictly adhered to, losses directly or indirectly due to material failure are still suffered. The very nature of the material renders it perishable in unskilled and inexperienced plating hands. Dielectric strength may be lost by absorption of salt solutions, bond of the conductor pattern may be weakened by the attack on adhesives, dimensions are changed by high temperatures, differences in co-efficient of expansion often reduce bond strength and even rupture hole walls, and so on unless proper process controls are used.

III. MANUFACTURING METHODS

It is not the intention of the writer to cover all of the aspects of printed circuit manufacture, but inasmuch as every single step taken by the copper-clad material on its route to the plating department exerts an influence on the quality of work the plater can produce, it might be appropriate from time to time to comment as briefly as possible on the operation and how it can, if omitted or improperly performed, contribute still another problem to the plating process.

The simple copper etched circuit results when a circuit drawing or pattern is transferred by photoprint, offset printing, or screen printing, to a sheet of copper clad laminate, followed by dissolving away or etching the exposed and unwanted copper not protected by the resist image. Care must be taken to avoid over-etching resulting in severe side etch (undercutting), see Fig. 4-D. The resist must, of course, completely protect the underlying copper foil and hold a clean line throughout the etching cycle. The importance of preparing the copper foil laminate for printing cannot be overemphasized. Cleaning, whether abrasive, detergent or solvent, is a prerequisite to obtaining an adherent resist coating. Problems in screen printing such as pin-holing, ragged edges, "fish eye" etc. can often be minimized by following the cleaning cycle with an appropriate acid dip and forced warm air drying. This, of course, adds another production step but will pay dividends in yielding optimum results.

Etching. Chromic acid and ferric chloride standard etching solutions are commonly used, but present a waste disposal problem. Good practice demands thorough neutralizing and rinsing after etching since any retention of ionic solution will greatly impair the electrical characteristics of the insulating board. The final step is the removal of the resist by suitable solvent, and when necessary to protect the copper from oxidation as in cases where assembly and dip soldering do not immediately follow, a chemical conversion coating or an organic film may be applied.

Inspection. Samples of each bath of etched panels are checked for electrical properties and solderability in a continuing process which involves placing test pieces in a humidity cabinet under a high voltage load for 24 hours at 95 per cent RH 115 F after which the resistance between two adjacent conductor strips $^1/_{16}$ in. apart is measured (25,000 megohms are considered minimum acceptable). Failures in this test indicate retention of ionic material due to inadequate or poor rinsing technique, insulating material of high absorption, poor choice of or improperly applied protective coating. The panel or a portion is then

TABLE 1

Plating	Purposes & Properties	Applications
Silver—Flash immersion	Short-term protection against oxidation of copper surface.	None that we can think of or recommend. Although it may look better for a short time it is difficult to dip solder after the silver becomes sulfided—also the usual objection to cyanides.
Gold—Flash immersion	Improve appearance of patterns, resistance to oxidation, better solderability.	Circuits which must be stored for extended periods prior to assembly and dip soldering. Acid bath preferred over cyanide.
Silver—Electroplated 0.0003 to 0.002	Corrosion resistance, low contact resistance.	Primarily used in printed switches or other printed patterns where contact must be made to pattern by pressure.
Gold—Electroplated 0.0001 to 0.0002	Excellent corrosion resistance, low contact resistance.	Used in switches or portions of printed circuits which plug in to connectors, where low contact resistance is extremely important.
Nickel—Electroplated 0.0003 to 0.001, plus gold 0.000030 to 0.000050	Hard, wear-resistant contact surface where low contact resistance is important.	Plug-in printed circuit boards and certain types of switches.
Nickel-Electroplated 0.0003 to 0.001 plus rhodium 0.000010 to 0.000050	Hardest wear-resistant wiping contact surface. Higher contact resistance than gold, but much longer wearing.	High speed, long wearing switches. Plug in contact fingers.
Solder—Electroplated 60-40 tin-lead alloy 0.0003 to 0.002	Improved solderability. Long-term protection against corrosion.	Plated thru holes boards where turret lugs, pins or eyelets must be joined to the conductor patterns simply by heating and fusing the solder.

dip-soldered and checked for wettability, balling, voids, delamination, blistering, and overall appearance of solder. Before any dip-soldering failures are attributed to faulty material or poor processing, it must, of course, be established that the dip solder pot is properly maintained and operated and that fluxes and dipping techniques are well chosen.

These, then, are adequate reasons why samples of every shipment of copper clad laminates should be tested under conditions simulating actual manufacturing processes before acceptance for production.

IV. PLATED CIRCUITS

Let us assume that we have just produced a plain etched copper printed circuit by one of the methods just described. Bare copper, under any condition where it is left clean and ready for electroplating or dip soldering, is always subject to atmospheric corrosion as well as contamination by airborne organic impurities, thus making it difficult to dip solder. Also, since copper is a comparatively soft metal with poor abrasion resistance, it will be unsuitable, for example, as a printed switch or commutator surface. If we are to circumvent these and other limitations of bare copper, the conductive pattern may be plated with another metal. Table I lists the various metals used commercially in plating printed circuits, together with a few of their purposes, properties and applications.

The bare etched copper pattern may be electroplated, provided all of the segments are electrically connected. It is often possible to design patterns with interconnecting segments or lines so that all parts of the conductor pattern which it is desirable to plate can be connected to a border around the panel or a portion of the pattern near the edge which is easily contacted by the rack or plating clamp (Fig. 1). These interconnecting lines may be removed in the final fabrication of the printed circuit, either by punching or drilling holes, or by cutting the border away from the panel.

In other cases it may be necessary within practical limits, to design the plating jigs, clamps or special devices, in such a manner as to make contact with electrically isolated segments of the pattern. These special plating devices frequently find application in differentially plating the mating pad portions of the plug-in circuits where a hard, wear-resistant surface is required. It might be well to point out here that it is usually more economical and practical from a standpoint of reliability to plate an entire circuit pattern with the same metal or composite metal coating that might be required on only a portion of the pattern. For example, if nickel-gold is required on one row of contact pads at the edge of a plug-in board to withstand the wear of numerous insertions, the necessity of designing special masking and plating devices, special handling and consequently low production, would be obviated by applying the same plating to the entire board. In this way the precious metal "wasted" will actually represent a saving in dollars and cents to say nothing of a more durable finished product.

Where the above conditions can be met, that is, all portions of the pattern electrically connected, the plating procedure is relatively simple. The copper surface is properly prepared, buffed to a low micro-surface if required, cleaned, attached to a plating clamp or rack, and made the cathode in a plating bath.

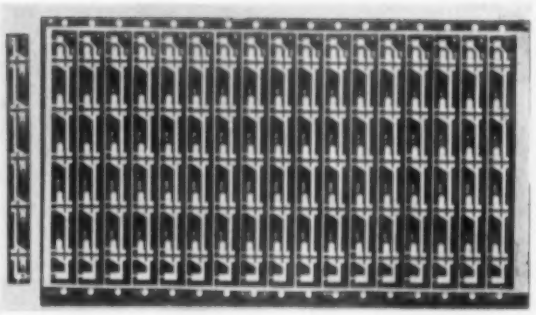


Fig. 1. Panel suitable for plating after etching. Lower portion shows a finished nickel rhodium plated circuit punched from upper board.

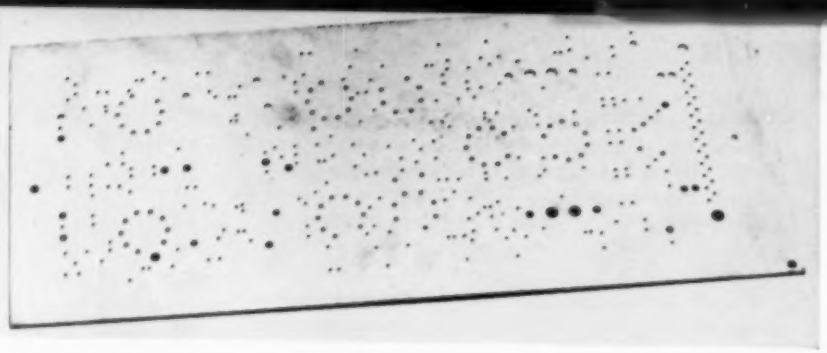
Courtesy National Vending Machine Co.

Outstanding advantages of producing a printed circuit by plating after etching is that the conductor pattern is entirely covered by the plated metals, no bare copper edges are exposed, sharp undercut edges are eliminated, smoother surfaces are possible because buffing before plating is more practical. The system does, however, have some drawbacks. In the first place it is not often possible to interconnect electrically all of the portions of the printed pattern. Secondly, during the plating process the exposed insulating material (where the copper foil has been etched away) is subjected to comparatively long periods of submersion in various chemical solutions and absorption to a greater or lesser degree will take place which, unless thoroughly removed, will have a resultant adverse effect on the dielectric strength of the laminate. Too, the adhesive that holds the circuit to the board may be weakened, particularly after plating in cyanide baths.

The fabrication of circuits plated after etching is further complicated by a tendency of the plated conductor strips, especially if stressed, bright nickel, to chip away, tear or even fracture along the drilling, routing or shearing edges.

We come now to the production of a plated printed circuit, employing the plated pattern method. Fig. 2-C shows the copper clad plastic printed with a plating resist in the reverse of the desired pattern, or in other words the background is printed. Since the copper foil is intact, electrical contact may be made on any part of the surface border. As the cathode in a plating bath, the desired metal is plated on the exposed copper only, the resist ink protecting the underlying copper background. After plating, the resist ink is removed and the copper thus exposed is dissolved in a chemical etchant which attacks the copper, but does not attack the electroplated metal. Thus, if the pattern is solder plated, the copper can be etched away with chromic acid, which does not attack electro-solder plate. Silver, in sufficient thickness, is not attacked by ferric chloride, and so a silver plated pattern may be produced by the same sequence of operations. Of course, if the electroplated metal is easily etched, it may be possible to electroplate the entire sheet of copper clad laminate before printing, and treat it as a normal etched circuit by printing the pattern directly (positive, as opposed to background, or negative) and etching through both the plated-on metal and copper. This last method is seldom used because it is uneconomical and it is also subject to production problems, since the two metals under consideration are rarely etched at the same rate and severe under-cutting of one of the metals is certain to take place. Besides this, plating thick-

Fig. 2A. Copper clad two-sided laminate with holes punched. The shaded areas shown above are copper foil, laminated plastic between them.



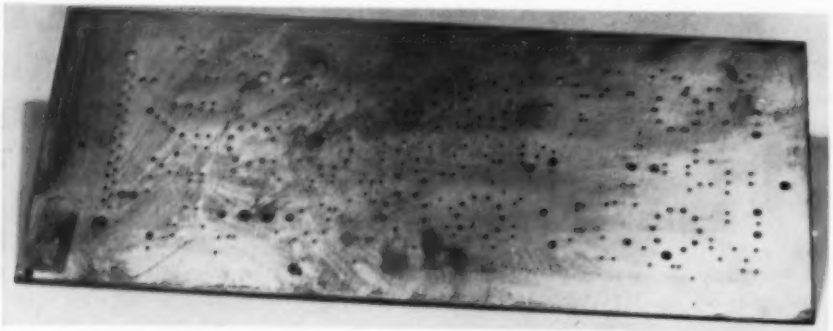


Fig. 2B. Holes sensitized with electrically conductive film. The two dark vertical lines, above, indicate conductive film.

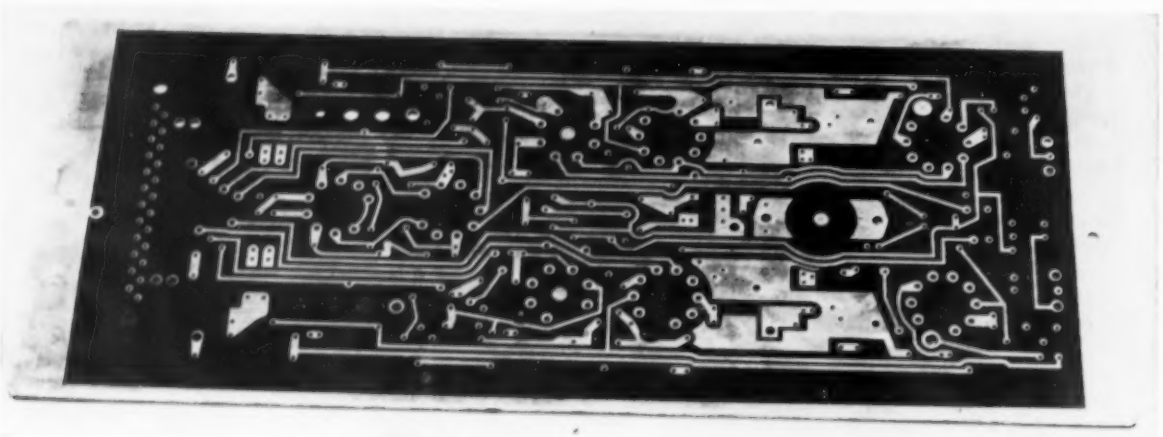
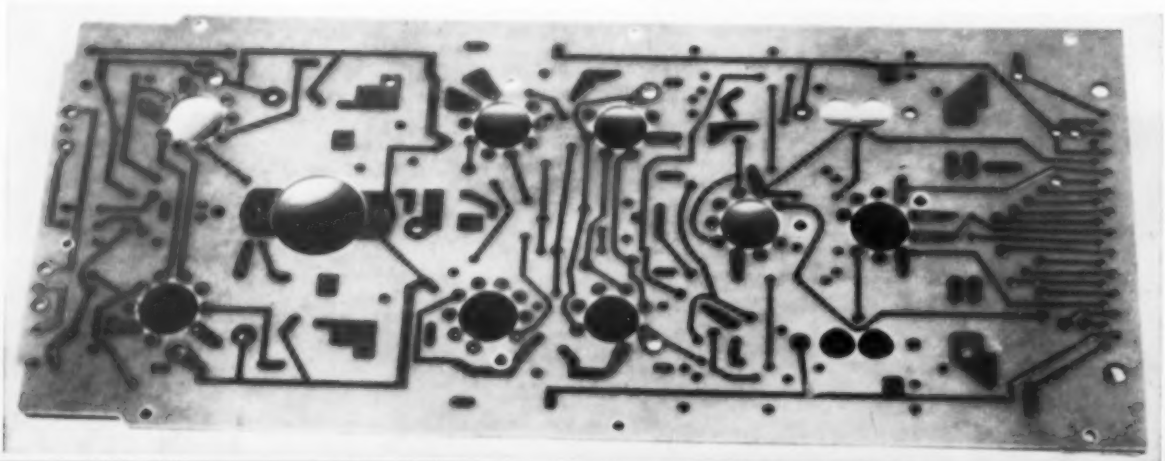
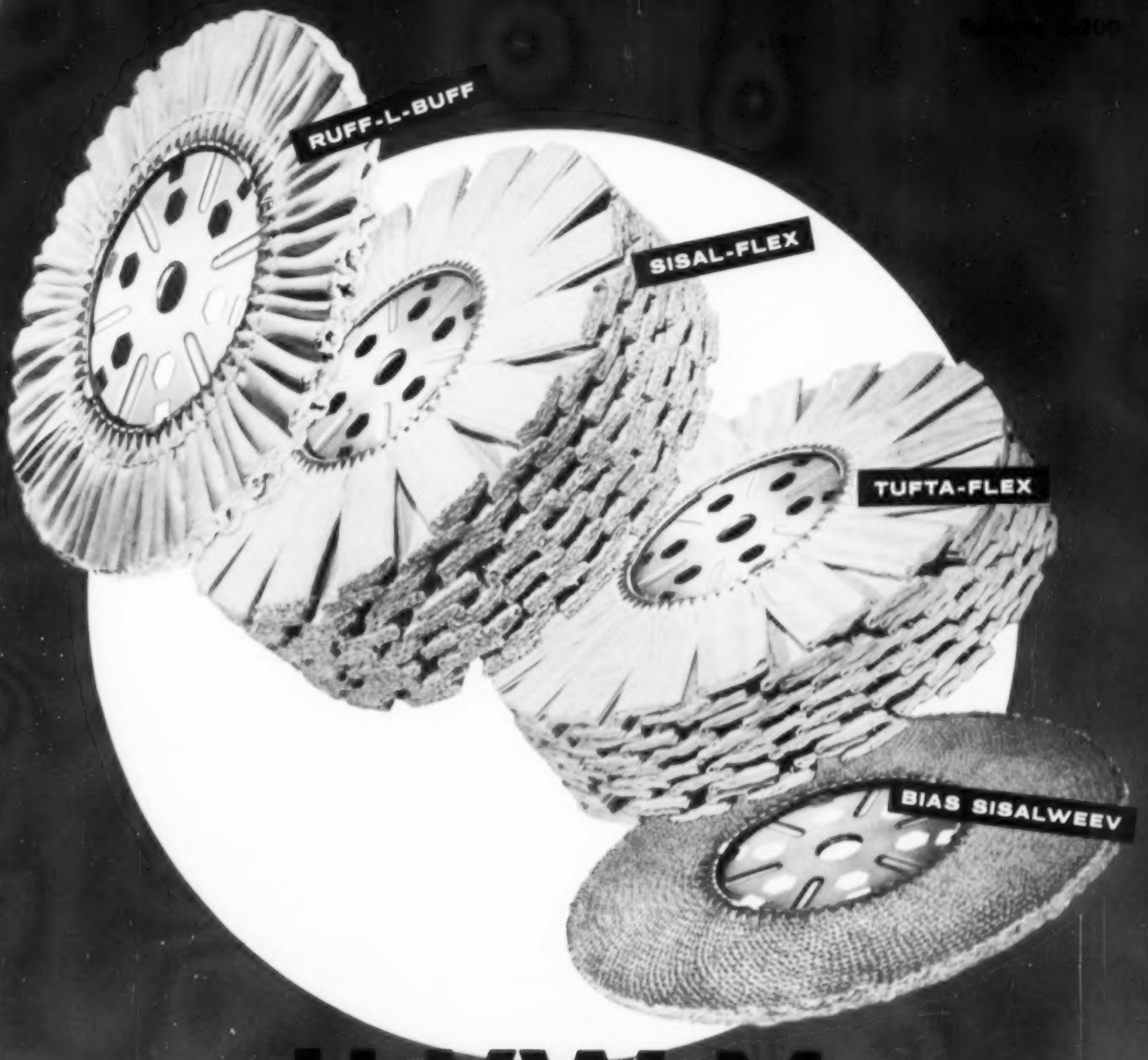


Fig. 2C. Resist pattern (background) applied.

Fig. 2D. Electroplated, resist removed, etched.





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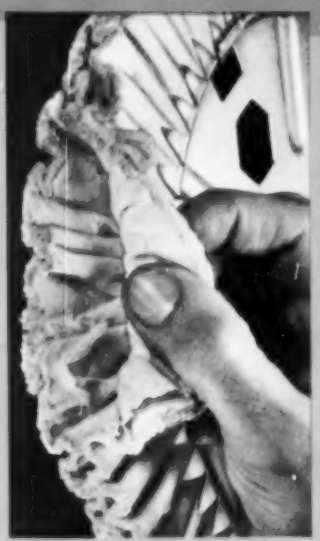

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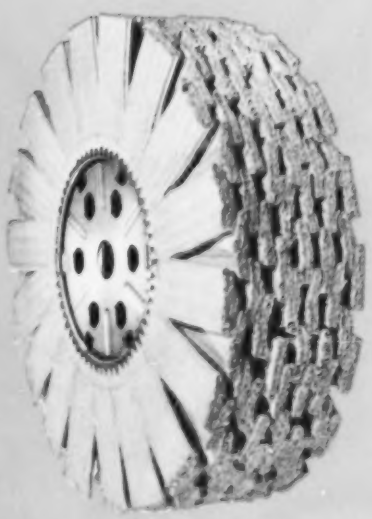

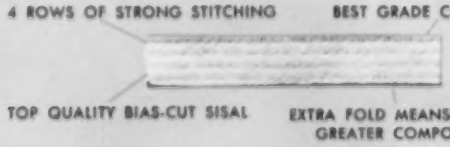
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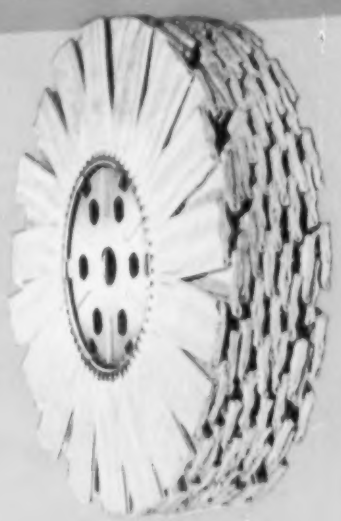

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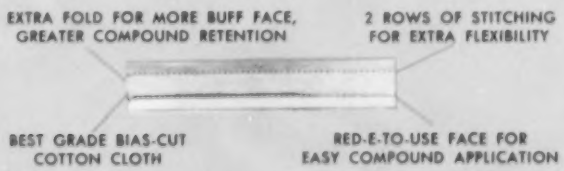
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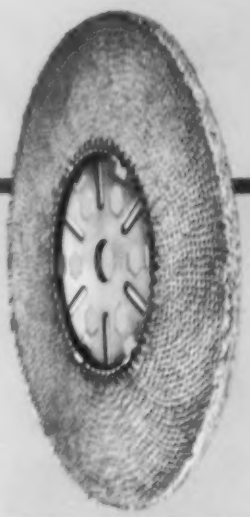

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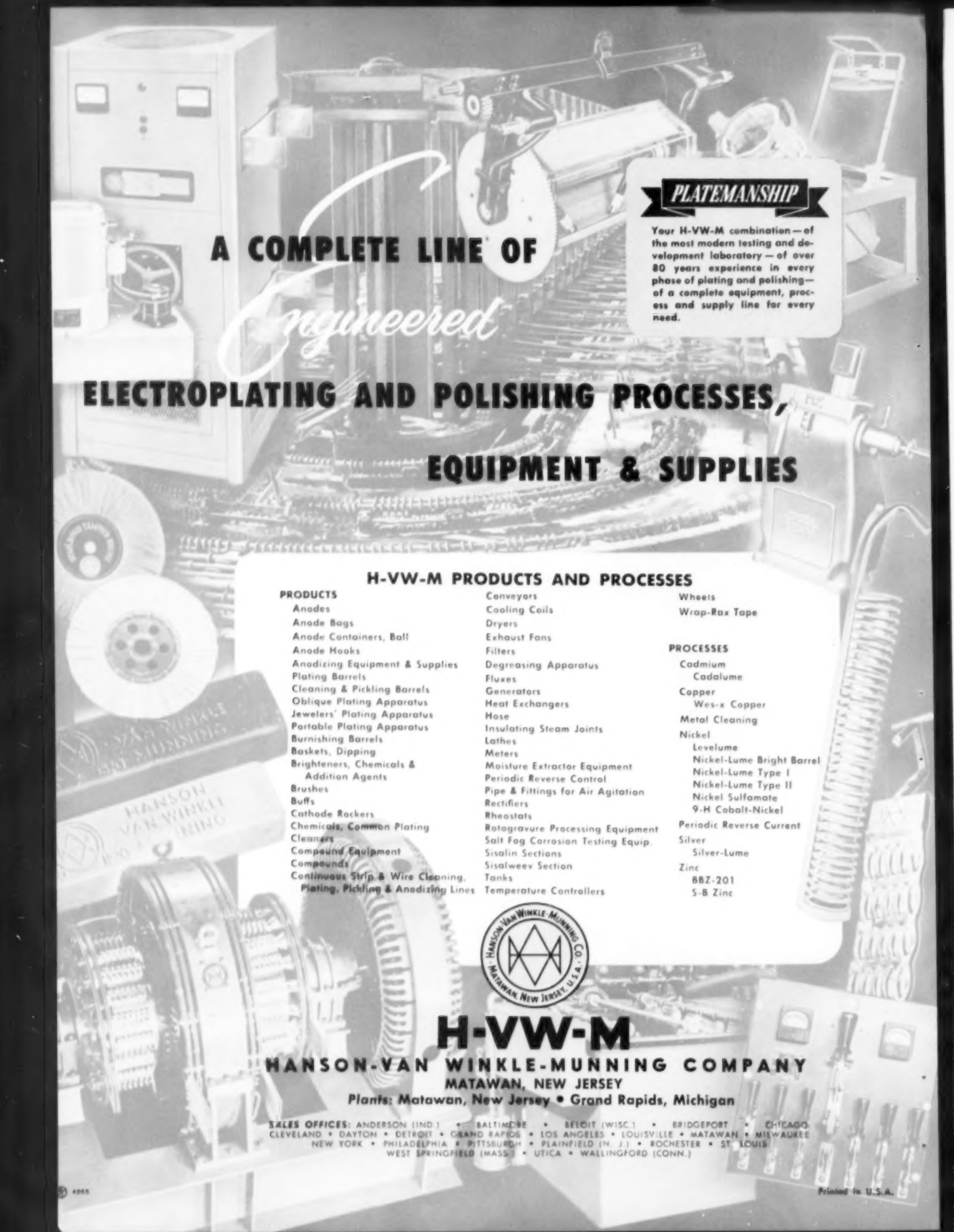

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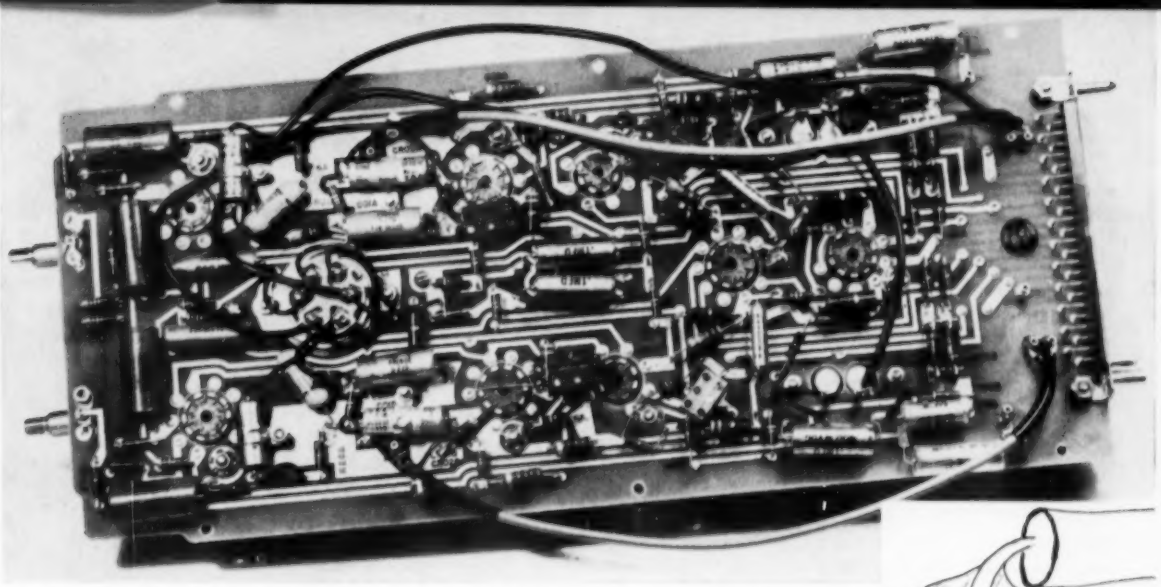


Fig. 2E. Dip-soldered board showing all component parts firmly connected to conductor pattern, as result of good solder flow through holes and formation of strong fillet joints. At right, dip-soldered component lead is firmly attached to board.

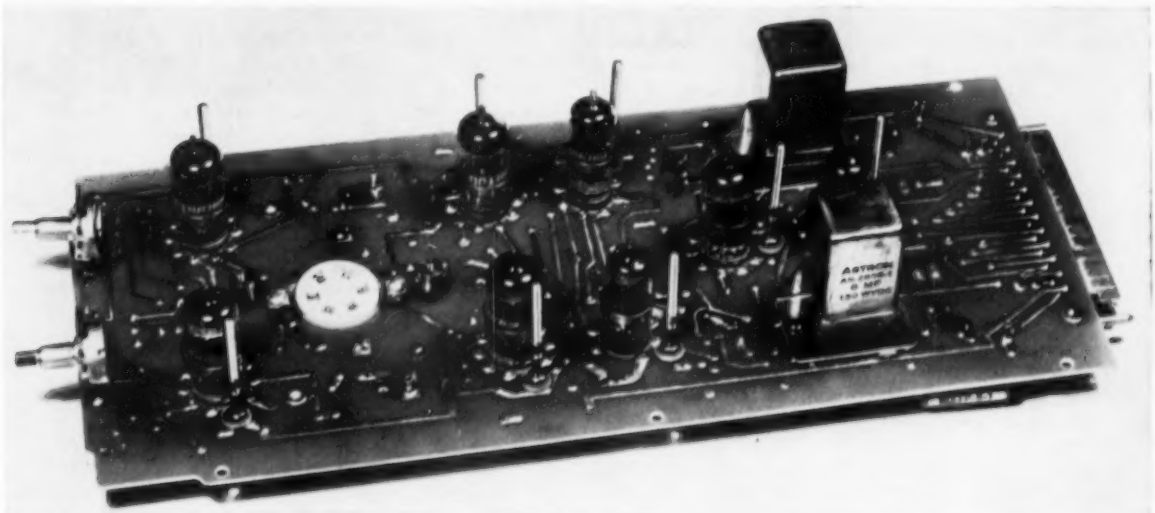
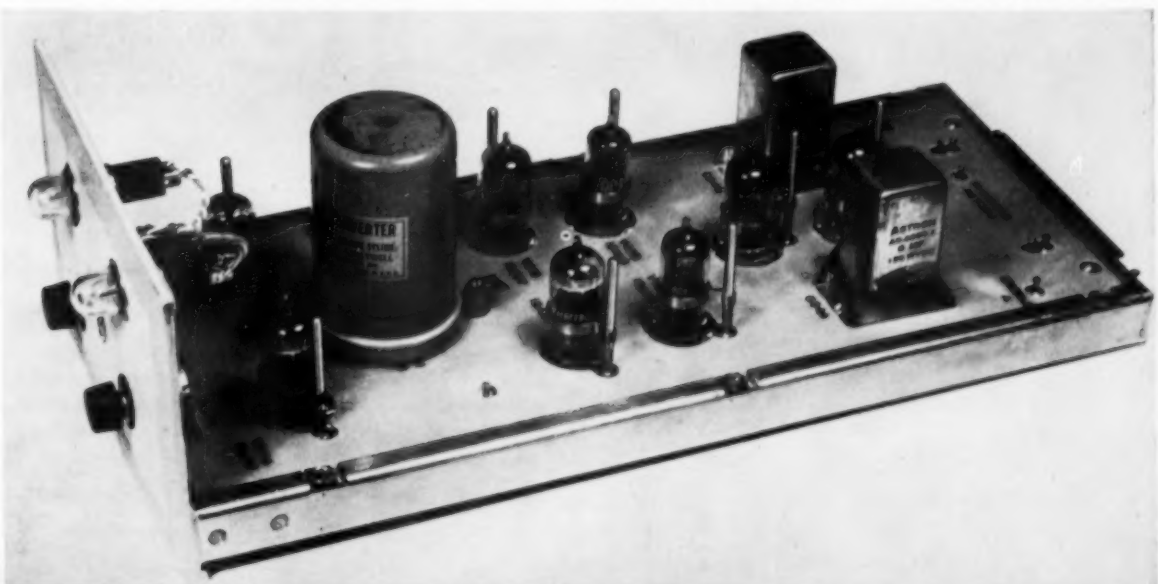


Fig. 2F. Reverse side of 2-D. The importance of reliable through connections is obvious.

Fig. 2G. Amplifier completely assembled and ready for mounting.



ness will vary on a large sheet due to edge build-up and center starvation.

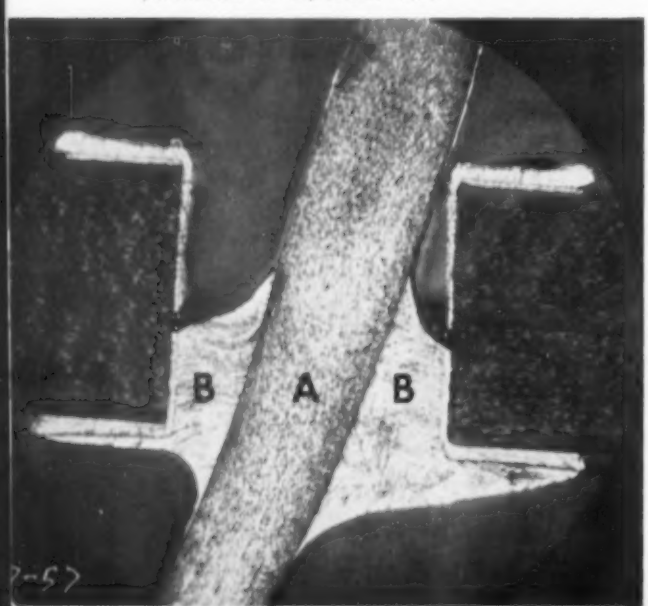
Up to this point, a few fairly simple processes for producing a plated printed circuit have been described. The reader is reminded, however, that in all these and the following processes a constant vigilance must be kept to safeguard against the hazards of the laminated material. Remember, too, that a flat panel, though a seemingly simple shape to plate, is not conducive to producing a coating of uniform thickness in the preferred acid plating baths. This is especially true when you consider that plating a flat surface on which there is a pattern describing segments of various individual areas often in ratios of 100 to 1, is in effect attempting to plate a collar button and an automobile bumper on the same string of wire. Plating technique, therefore, is quite important and operating conditions may of necessity be changed with each lot of panels processed. The baths, tanks and other equipment must be versatile enough to readily make changes in agitation, bath temperature, anode-cathode spacing, current density, cleaning cycles, etc.

V. PLATING THROUGH HOLES

A comparatively recent advance in the manufacture of printed circuits is the system for plating through holes. When printed conductors are used on both sides of the board in order to make a large number of cross-overs, or where space on one side of the board is limited, through connections from one side of the board to the other must be made. Although these connections can be made by wire leads, eyelets or rivets inserted into the board, they are usually more economically and reliably made by the plating through process. In addition, dip solder joints between the component leads and conductor pattern are much stronger when plated holes are used because the solder will flow up and around the component wires in the holes and form fillets on both the top and bottom of the board. The solder joints made in this way have greater shock and vibration resistance with a lack of intermittent connections.

A printed circuit with plated through holes may be made by first punching or drilling holes in the proper locations through a sheet of copper clad laminate. The insides of these holes are then made electrically conductive either with graphite or with a thin metallic film applied by chemical process (reduced silver, copper, electroless nickel, etc.) or vacuum deposition. The reverse (background) pattern is then printed on both surfaces of the board. The holes to be plated, of course, are in the circuit pattern and therefore are not covered by resist ink. The panel is then plated in a copper bath. Copper is electrodeposited on the copper clad surface pattern and also on the walls of the holes which have been made electrically conductive as described. The panel is then transferred to a plating bath where the metal which is to act as the etch resist is deposited on the surface and through the holes. The ink is then removed and the unwanted copper (background) is etched away in a suitable chemical etchant which does not attack the final plated metal. Figs. 2-A to 2-F show a step-by-step progression of this system.

Fig. 3. Photomicrograph showing cross section of plated hole which failed to dip solder. Note rupture of hole wall at point where plating thickness is inadequate. **A**—Component lead. **B**—Dip solder. X50.



Plated through holes offer a greater degree of reliability than can be achieved with any other type of through connection. This statement can be made only when certain requirements are met. Although the subject is not entirely within the scope of this article it is important enough to make a few comments on these requirements.

One of the chief causes of failure in plated through holes is insufficient thickness of copper. A thin film will easily rupture and crack under conditions causing a differential in co-efficient of expansion between metal and plastic. Since the plated hole wall is thus too weak structurally to hold its electroformed shape, cracks occur. The slightest crack, therefore, will interrupt the heat transfer during dip soldering and prevent the molten solder from flowing up through the holes to form a strong fillet around the component leads. (Fig. 3)

Literally hundreds of photo micrographs of sectioned plated holes were studied to determine the minimum thickness necessary to meet the physical and electrical requirements of an absolutely reliable through connection. It was found that a hole wall thickness of copper not less than 0.0015 and preferably 0.002 is necessary to insure good solderability (heat transfer in dip soldering operation) strong solder joints (fillets) and perfect electrical conductivity. When laminates of $\frac{1}{8}$ in. or thicker are plated through, a heavy copper deposit of 0.002 to 0.003 in the holes is almost mandatory. (Fig. 4)

So much for what is needed. Now how is it obtained? Obviously a copper bath with good throwing power will hold the ratio of surface thickness versus hole thickness at a minimum. Operating conditions of the copper bath should be adjusted to obtain an evenly distributed, fine-grained, ductile and smooth deposit free of treeing, spreading, saucer-shaped lands around the holes and other evidence of edge build-up. This is a tall order, not easily filled, but it can and is being done.

The first type of copper bath to come to mind is the high-speed copper cyanide bath but, unfortunately, cyanide baths, especially at elevated temperatures and most certainly with agitation, play the very devil with resist inks and plastics.

Practically all of the acid copper baths in common use are doing a good job of plating printed circuits, and each plater has his own personal preference for one reason or another. Simple addition agents like molasses and glue, as well as proprietary addition agents, are almost universally used. Considerable experimenting, not only with

chemical additives, but also with operating conditions, is necessary before the right combination is found, and when a thickness of 0.003 copper (0.006 on the diameter) on the hole wall has been deposited while only 0.005 thickness has deposited on the flat panel surface, a good job has been done.

VI. PLATE-ON

Another comparatively new process is the "plate-on" circuit. This process has been exploited by Motorola, General Electric and others, and is today being successfully mass-produced. Its primary advantage is economic, in that it uses a less expensive material other than copper clad laminate, and produces plated through holes at the same time that the circuit is formed. Copper is thus deposited only as the electro-formed circuit, canceling out the necessity for, and expense of, etching.

Essentially, this method uses a bare laminate which is cut into panels or strips. Holes are punched or drilled just as was done with the copper clad material in the plate-through holes process. The panels are coated with a thin layer of adhesive which is dried and partially cured, then a very thin layer of copper, silver or nickel is deposited on the adhesive surface by one of several methods. Silver may be applied by chemical reduction. This utilizes the double nozzle spray technique where one nozzle sprays the silver solution and the other nozzle sprays a reducing solution which deposits a silver mirror-like deposit on the surface.

Copper may be deposited by a copper-reduction bulk treating process. Nickel may be deposited chemically in much the same way as copper. After the thin conductive layer is applied to both sides of the board and the insides of the holes, the reverse of the pattern is printed both sides with a plating resist. Copper is then electroplated in the form of the desired conductor pattern on both surfaces and through the holes. After removal of the resist image and removal of the thin metal film, either by mechanical brushing or chemical dip, the printed circuit is virtually finished. All that remains is a post-baking or pressing operation to improve bond strength of the copper circuit to the board. Piercing in additional holes or notches and blanking the circuit to its required outline is the final step. Semi-automatic equipment has been constructed to carry out all these processes.

The important stumbling block in the "plate-on" process is the problem of bond-strength between the metal conductor and the insulating board. Though satisfactory for some applications it is generally conceded that the adhesion of the copper conductors in a conventional etched circuit using copper clad laminate is superior.

VII. PROBLEMS

It is not possible in an article of this scope to cover all of the production problems encountered in the electroplating of printed circuits. Generally speaking, all electroplating processes are subject to many difficulties unless held under the tightest of controls. In the printed circuit field, other problems are compounded by many factors, such as the inability of resist materials to stand strong cleaning solutions, the influence of pattern configuration on current density and uniform plating thickness, the fact that the laminated plastics are often adversely affected by the plating solutions, contamination of the plating baths by the panels being plated, and many others. Perhaps the best way to cover the topic is to list several DO's and DON'Ts.

Do's

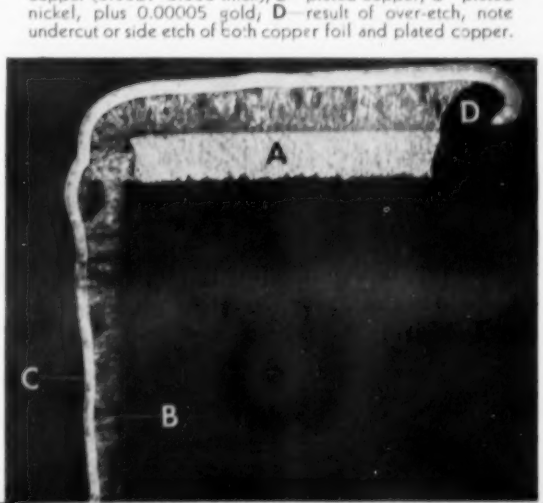
1. *Be sure that the surfaces to be plated on are chemically clean.* Poor adhesion of the overplate to the base copper is probably the problem which most often arises. The cleaning cycle must be tailor-made to fit the job. A tape test for adhesion will usually decide whether or not the cleaning cycle was well chosen.

2. *Calculate and control current densities carefully.* Any experienced plater will readily know when he has exceeded the permissible current density of a given bath. The signs, of course, are treeing, burning, roughness and particularly with printed circuits, resist breakdown due to excess hydrogen gas evolution, and burning away of metal at contact points. Determination of the area to be plated might be difficult because of the configuration of the printed patterns, but you can't duck the problem because unlike most irregularly shaped objects, *every segment*, no matter how large or small, on the surface of the printed circuit panel is a *significant surface* and thickness tolerances must be held. With modern equipment it is possible to make a fairly accurate estimation of surface area by placing a flat panel of known area in the plating tank and adjusting controls to the desired current density. The panel is then removed and without changing control settings, a printed pattern is hung in the tank, and the difference in amperage noted. By simple calculation a fairly accurate estimate of surface area on the printed panel may be determined. In alloy plating such as tin-lead solder, the current density largely determines the ratio of tin to lead in the deposit. Thus, at 30 asf a 60–40 tin lead alloy will be deposited, whereas at 25 asf a deposit much higher in tin will be plated out and will later require excessively high dip soldering temperatures.

3. *Control plating baths by frequent chemical analysis.* Plating baths, when used continually, get out of balance in their chemical make-up. The control of a solder plating bath, for example, is particularly important since changes in concentrations can lead to a deposit other than the desired 60 per cent tin 40 per cent lead. Any deposit other than this eutectic alloy will raise the melting point and lead to difficulty in dip soldering. If analytical facilities are not at hand, deal with a reliable supplier, offering technical service, and have frequent analyses made.

Make daily thickness checks, particularly on baths which vary in cathode efficiency as metal concentrations

Fig. 4. Section of plated through hole showing—**A**—2 oz copper (0.0027–0.003 thick), **B**—plated copper, **C**—plated nickel, plus 0.00005 gold, **D**—result of over-etch, note undercut or side etch of both copper foil and plated copper.



change. A rhodium bath, for example, is sensitive to changes in operating conditions and it therefore is wise to check average thickness by the weighed cathode method at least once each day of operation.

4. *Keep the plating baths clean.* Continuous filtration is desirable. Printed circuit panels introduce dust, ink chips, reaction and breakdown products into the plating bath. Batch carbon treat periodically according to a practical schedule. Usually copper is the basis metal. This practically eliminates the possibility of metallic contamination by zinc and iron—a happy thought—but in its place there is the ever-present organic contamination by waxes, solvents, asphalts, dyes, resins, adhesives, etc. and therefore the necessity for the carbon batch treatment.

Keep tanks covered when not in use. This will not only keep dust from settling on solution surfaces but in the case of solder baths, cut down on oxidation of stannous tin to stannic. Fluorescent lights are also said to have this effect on solder baths.

Maintain solution level of precious metal baths by making additions from a reserve supply of carbon treated drag-out bath. This applies especially to rhodium solutions which are sensitive to organic contaminants. Good practice is to transfer work from the plating bath to the drag-out rinse without delay. This will avoid introducing the more heavily contaminated drainage from the cathode surface to the plating bath, and will greatly extend the life of the bath. This extra care seems justified in view of the fact that for printed circuit plating a concentration of 5 g/l rhodium is desirable, bringing the cost of a 40-gallon bath to about $5000.00.

5. *Keep plating hooks, racks, tank busbars, etc. clean.* This would be standard practice in a well-operated plating shop or department. Be sure the plating hooks, clamps or racks make good electrical contact and are adequate to carry the required amperage.

6. *Rinse thoroughly before and after entering cleaning and plating baths.* Running rinses and spray rinses are necessary. A spray rinse should precede immersion in the electroplating bath. After plating, rinsing is just as important since any ionic material left on the printed circuit in its finished state will lead to electrical troubles later on.

7. *Have someone in the shop with about 20 years' plating experience.* Give him the authority and support needed to back his judgment without expecting him to conduct an "on the spot" school. It has been said that major problems are divided to result in 90 per cent people problems and only 10 per cent equipment and materials problems. Lack of experience with the process is often a lesser hazard than a divided opinion within an organization as to its value.

Don'ts

1. *Don't use base materials which are adversely affected by plating solutions when plating circuits which have already been etched.* As mentioned before, certain adhesives used to bond the copper foil to the base material are destroyed by high alkaline cyanide plating baths. Don't accept a laminate material for production until a piece has been run through the plating cycle and then checked for bond strength and electrical leakage resistance between printed conductors.

2. *Don't be discouraged when you find a wide difference in plating thickness on portions of a panel.* Thicknesses may vary by as much as 50 per cent from edge to center. Border margins, static thieves, agitation, anode spacing, current density and other operating conditions may alleviate, but not entirely eliminate, the problem. Any factor that will increase the covering power of a bath will, of course, be helpful.

3. *Don't assume a familiarity with a strange job.* The apparently simple jobs are often deceiving. Since salvaging a printed circuit plating reject is rarely successful, a safe course is to process one or two panels to determine what, if any, problems are likely to arise.

CONCLUSION

To the plater who must decide whether he should take on printed circuit plating and the responsibility that goes with it, this article may appear somewhat discouraging. To those who have been "through the mill" it will, I am sure, only confirm what they have experienced, and I am equally certain of agreement that it would be quite difficult and actually misleading to describe the processes as a simple "routine plating job."

The growth and present-day status of the printed circuit is largely due to the research and development sponsored by the relatively few companies devoted exclusively to their manufacture. The need for the right materials, equipment, chemicals, techniques etc. indicated right from the beginning the necessity for a specially designed plating department and a continuous program for the evaluation of and search for new commercial materials.

It seems axiomatic therefore that we are not dealing with a "simple routine plating job" when discussing plating of printed circuits, and to the plater contemplating entering this field, the foregoing is not intended to discourage, but rather to offer a genuine service by causing him to pause for a moment and give sober thought to his ability to meet the challenge, to weigh the economies of setting up to do a "proper" job—in other words, consider all the aspects and take a long look before impulsively jumping in with both feet.

Nelson Foran attended New York University and Brooklyn Polytechnical Institute of Technology. During World War II he served in China as a Naval Intelligence Officer.

In 1946, Mr. Foran joined the Specialized Plating Company of Brooklyn where he acquired a valuable background of practical plating experience. He later joined the staff of Fairchild Engine Company where he supervised work for the Atomic Energy Commission and the operation of the largest nickel plating installation in the East.

In 1955, he became a member of the Research and Development staff of Photocircuits Corporation, Glen Cove, New York. He is presently engaged in the development of new and improved plating methods in the manufacture of printed circuits.

NONDESTRUCTIVE THICKNESS MEASUREMENT OF ANODIZING USING THE INTERFERENCE MICROSCOPE

by ROGER L. SAUR*

The interference microscope is used to measure transparent anodic film thickness on aluminum and aluminum alloys in the range 0.00005 to 0.0008 in. with an accuracy of about ±0.00002 in. The method is fast, absolute, and nondestructive.

As THE THICKNESS of its anodic film is an important factor in the corrosion resistance of aluminum alloys, better methods for measuring the anodic film thickness are desired.

A new method has been found for measuring the film thickness of such transparent anodic films. Given an interference microscope with two sources of light that can be used interchangeably, one white light, the other monochromatic, then the thickness of anodized aluminum coatings within a range of at least 0.00005-0.00080 in. can be determined quickly and without damage to the coating. The accuracy of the measurement is about ±0.00002 in.

Thomas and Rouze[1] described a method whereby observed shift or deviation of light fringes[2] from straight lines was utilized for accurate determination of the thickness of chromium and other thin electrodeposits at the edge of the stripped overlay. In the present application, anodized film thickness is determined by counting the number of fringes between two points on the surface previously established with the aid of white light; no stripping is necessary.

THICKNESS MEASUREMENT

The method for establishing the interval on the surface of the specimen to be subsequently measured with the aid of the monochromatic light fringes may be best described with the aid of Fig. 1. The article on which it is desired to measure the anodic coating thickness "t" is represented schematically in this figure. The mirror of the interference microscope is shown superimposed at a grazing angle (of the order of one degree). Within the instrument this superimposition is, of course, not real but is accomplished in effect by means of a system of mirrors. The specimen itself is, for our purpose, regarded as another mirror. The light is reflected from the top *surface of the oxide coating and more* intensely from the aluminum oxide-aluminum interface. At the points t_0 and t_1 where the superimposed mirror apparently intersects the outer and inner surfaces of the oxide coating, light interference is complete and through the microscope a dark band appears. On either side of this dark band, colored light fringes appear which help locate this dark band. The distance between t_0 and t_1 ideally would then be marked on the specimen, but it is much more convenient to establish these two locations with the help of a measuring (reticle) eyepiece.

Depending upon the transparency of the oxide coating, other less intense groups of fringes may be detected at positions t_2 and possibly t_3. The lateral distance as determined by the eyepiece between t_2 and t_3 would be the same as the distance between t_2 and t_1, or between t_1 and t_0, assuming that the coating thickness is the same at these locations. Fringes at t_2 develop because some of the light reflected from the aluminum metal is reflected downward from the outer surface of the aluminum oxide coating and then back. At t_3 this reflectance occurs twice from each surface. This double reflectance apparently doubles the coating thickness at t_2 and trebles it at t_3. The whole effect is very similar to that observed in a barber shop which has mirrors on opposite walls. There the secondary image appears to be behind the first and so on until finally the images fade out in the distance.

Then without shifting anything else, the light character is altered to monochromatic, and the number of fringes in the reticle interval between white light fringe group centers previously observed is counted (see Fig. 2). As the interval of one interference fringe corresponds to a surface elevation change between mirror and sample of one half the wavelength of light used, the thickness of the film can be computed. With green monochromatic light, the fringe interval corresponds to about 0.000010 in. elevation change. The

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optical thickness of the film is computed by multiplying the fringe interval by the number of monochromatic fringes counted between white light fringe groups. This must be divided by the refractive index of the film (about 1.6 for aluminum anodic films) to obtain the mechanical (actual) thickness. Data by this method are labeled "interferometer" in the table.

Example: Thirty-two fringes associated with an anodic

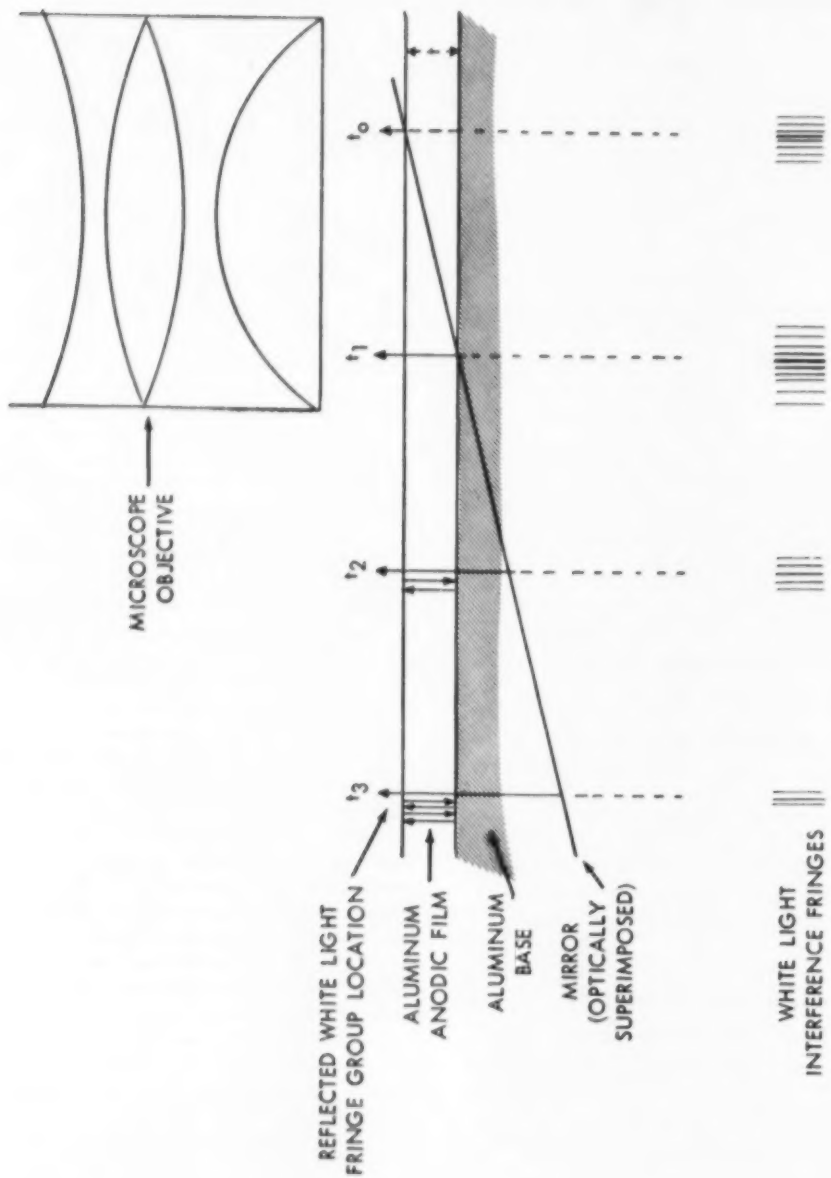

Fig. 1—Drawing showing location and mechanism of formation of white light interference fringes.

film were counted in the interval occupied between centers of white light fringe groups.

$$\frac{32 \text{ (fringes optical thickness)} \times 0.000010 \text{ (in./fringe)}}{1.6 \text{ (optical thickness/mechanical thickness)}} = 0.00020 \text{ in. mechanical (actual) thickness}$$

REFRACTIVE INDEX MEASUREMENT

The interference microscope was also used to determine the refractive index of the anodic film. This was done by obtaining the ratio of the optical thickness to the mechanical thickness at the edge of a stripped portion of the film (see Fig. 3). As the monochromatic fringes can be seen from only the inner reflecting surface, and cannot be seen from the outer surface of the anodic film, the white light fringes must be used to locate the outer surface. Consequently, the interference microscope is set up as described with white light fringes, and the field of view located over the stripped edge of the anodizing. The white light fringe centers are located on the reticle for the top anodizing surface and for the bare metal surface. Switching over to monochromatic light, the fringe count in this interval multiplied by the fringe factor (0.00001 for green monochromatic light) gives the mechanical (actual) film thickness. The optical (apparent) film thickness is determined by the same method, except that count is made from the top of the anodic film to the metal surface beneath the anodizing; this count multiplied by 0.00001 for green monochromatic light gives the optical thickness. The ratio of the optical thickness t_o to the mechanical thickness t_m is the refractive index μ:

$$\frac{t_o}{t_m} = \mu$$

For the four alloys mentioned in this article and for a thickness range of 0.00005 to 0.00080 in., the refractive index of the anodic film on aluminum was 1.6 ± 0.1. This agrees well with the alpha-monohydrate value of 1.62 and deviates somewhat for alpha alumina (1.76) and the alpha trihydrate (1.56). This indicates that the anodic film may approximate the alpha alumina monohydrate in composition, $Al_2O_3 \cdot H_2O$.

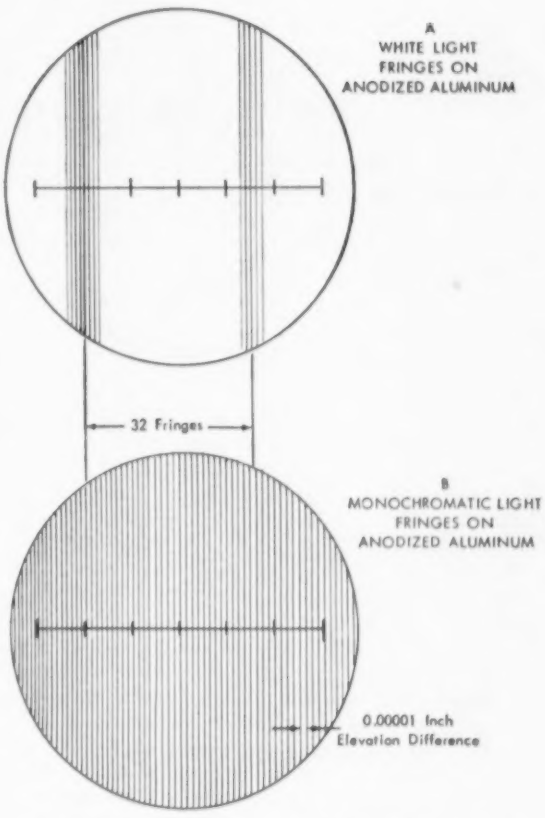

Fig. 2—Drawing of interference fringes, A white light and, B, monochromatic light as see through microscope on anodized aluminum.

REFEREE METHODS

The first standard thickness measurement technique utilized mechanical thickness measurement with an interference microscope at the edge of a stripped film. This has already been described under "Refractive Index Measurement." Data by this method are labeled "stripped" in the table. A section of electroplaters' masking tape was applied to the anodized sample, which was then immersed for about 10 minutes in the 190 F stripping solution to remove the exposed anodic film. (The stripping solution consisted of 68 grams—2.5 ounces—CrO_3 and 135 milliliters concentrated H_3PO_4 in a gallon of water.)

The other method consisted of cutting the sample, mounting, and polishing its edge. Thickness measurements were then made at 1000X magnification using a microscope with a calibrated reticle eyepiece. The results of these measurements are tabulated under "cross-sectioned" in the table. Two independent measurements, labeled "No. 1" and "No. 2", were made on a set of mounted samples.

RESULTS

Anodic film thickness data are tabulated in the accompanying table for a series of samples for each of four aluminum alloys.

Variations in interferometric thickness measurement from referee results may arise from the varying locations in which the measurements were made, as the films were not of uniform thickness.

The corresponding samples of Swiss-O, AA EC, and AA 5357 alloys were anodized under identical conditions and time; therefore, it would be expected that the anodic film thickness of the first sample of each of these alloys would be about the same as that of the first of the other two alloys, and so on. While the anodizing thicknesses of the corresponding samples of AA EC and AA 5357 alloys are comparable, the anodic films of the purer Swiss-O alloy are appreciably thicker.

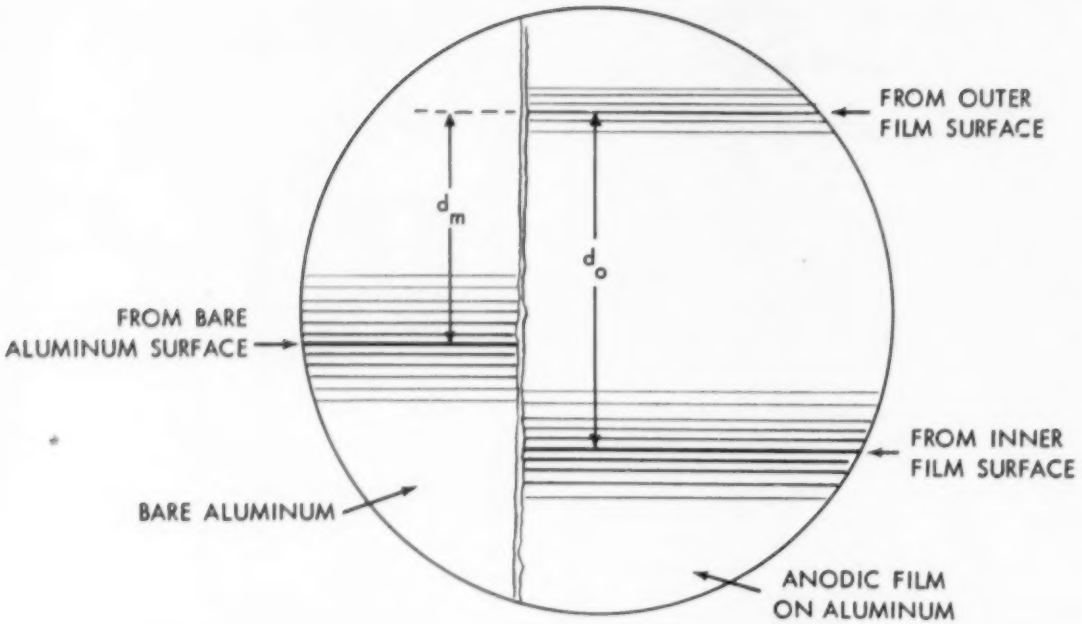

Fig. 3—Drawing of white light interference fringes across boundary of stripped anodizing as seen through microscope. The optical thickness (in inches) of the film t_o equals the number of green monochromatic fringes counted in distance d_o, multiplied by 0.00001; the mechanical thickness of the film t_m equals the number of green monochromatic fringes counted in distance d_m, multiplied by 0.00001. The refractive index μ is then

$$\mu = \frac{t_o}{t_m}$$

COMPARISON OF THICKNESS

Aluminum	Interferometer	Referee Method: Stripped	Referee Method: Cross-Sectioned No. 1	Referee Method: Cross-Sectioned No. 2
	Inches	Inches	Inches	Inches
Swiss-O (99.99% aluminum—flat samples)	0.00012	0.00014		
	0.00017	0.00016		
	0.00038	0.00037		
	0.00080	0.00085		
AA EC (99.45% aluminum—flat samples)	0.00007	0.00008		
	0.00010	0.00010		
	0.00019	0.00020		
	0.00045	0.00049		
AA 5357 (98.2% aluminum flat samples)	0.00007	0.00007		
	0.00011	0.00011		
	0.00019	0.00020		
	0.00043	0.00047		
AA 6063 (97.9% aluminum—extruded—curved samples)	0.00015	0.00014	0.00016	0.00018
	0.00032	0.00031	0.00036	0.00036
	0.00055	0.00045	0.00052	0.00045
	0.00015	.....	0.00016	0.00016
	0.00031	0.00039	0.00036	0.00036
	0.00052	0.00053	0.00052	0.00045

REFERENCE

[1]Rouze, S. R., and J. D. Thomas, "Using the Interference Microscope for Thickness Measurements of Decorative Chromium Plating," Plating, **42**, pp. 55-58 (1955).

[2]Monk, George S., "Light: Principles and Experiments," (Describes operation of a double-beam interferometer), pp. 143-152, McGraw-Hill Book Co., New York (1937).

Roger L. Saur received his BS in Chemistry in 1943 and his PhD in 1949 from Michigan State University. Since then he has worked at the General Motors Research Staff, Detroit, Michigan. Until 1955 he worked in the Physics-Instrumentation Department on the photochemical deterioration of automobile lacquer and other diversified projects. Since that time, he has worked in the Electrochemistry Department on various problems in electrochemistry and physics.

BRIGHT NICKEL PLATING IN THE COSTUME JEWELRY INDUSTRY

by EUGENE N. CASTELLANO*

BRIGHT NICKEL PLATING has tremendously enhanced the market for that segment of the jewelry industry primarily concerned with the manufacture of costume jewelry. Costume jewelry, of course, is low—and medium-priced jewelry. With the use of bright nickel processes, the costume jewelry manufacturer has been able to achieve a better and more uniform article—and also reduce manufacturing costs and plating time.

The history of jewelry manufacturing began in the United States late in the 1700's, its exact origin was never recorded. Legend says that a soldier in Lafayette's Army was the first jewelry manufacturer to open a shop in an area called North Attleboro in Massachusetts.

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The control laboratory of the B. & J. Jewelry Company.

JEWELRY VOLUME AND EMPLOYMENT

Nearly $200 million dollars worth of low and medium-priced jewelry is produced annually in the United States. The Providence-Attleboro area alone produces approximately 80 per cent of this volume. In the United States, there are approximately 1200 costume jewelry manufacturers. Nearly 800 are located in the Providence-Attleboro area and 400 in the New York-New Jersey area. The total United States employment in this industry averages about 50,000 persons of which 70 per cent are located in the Providence-Attleboro area, about 20 per cent employed in the New York-New Jersey area and the remaining 10 per cent or less in other parts of the country. The total volume does not comprise only women's jewelry; men's jewelry accounts for a large portion of it.

THE NEW ENGLAND ASSOCIATION

The New England Manufacturing Jewelers and Silversmiths Association, which traces its history to the 1880's, is a driving force in the jewelry industry. It numbers 420 member firms across the nation and includes all major segments of the industry. The association, in cooperation with state and local school education authorities, runs an electroplating course for jewelry manufacturers' employes at Central High School in Providence, Rhode Island and another at the Attleboro High School in Attleboro Massachusetts.

The courses in the Attleboro High School are taught by Omer Jette, owner of the B. & J. Jewelry Company of Attleboro Falls. Joseph Smith Jr., chemist for the Smith Chemical Company of Providence, teaches at Providence, Central High School. The four-hour classes meet one afternoon a week from 1:00 to 5:00. Both are two-year courses—the first year consisting of basic chemistry and solution makeup and the second year, analyses and troubleshooting. The companies are permitted to send anyone from the plating room and some companies have the entire plating

shop attending. Regular wages are paid the students while attending school.

MAJOR BASE METALS USED

The major base metals used by the costume jewelry industry are brass and white metal. The brass, sometimes called the rich-low brass, is an alloy of 85 per cent copper and 15 per cent zinc which has a natural gold-like color. Brass is used in a much greater volume since it is the basis for all the costume jewelry stamped as formed. The white metal is used for castings and can be composed of a variety of alloys such as 98 per cent tin and 2 per cent antimony or 90 per cent lead and 10 per cent tin or antimony, or slush metal which can be 50 per cent lead and 50 per cent tin and antimony. The brass must be of good grade with low

Hand polishing of unplated tie pins.

metallic impurities and no surface imperfections which, if present, are always magnified by the subsequent bright nickel plate.

PROCESSING

Upon its receipt, the brass is formed or stamped to shape or design. The parts are then grease buffed—a cutting operation prior to polishing. They next are polished and color buffed to a high luster. The polishing is done manually on each part individually. Parts are then cleaned cathodically in a good brass electrocleaner, rinsed in cold water, dipped in either diluted sulfuric or muriatic acid solution. After rinsing they are ready for plating. A copper strike is optional, but not many companies use it. Most go directly into the bright nickel and usually plate from 5-12 minutes, depending on the article, or individual doing the plating. Nickel thicknesses vary anywhere from 0.0001 to 0.001 in. of plated deposit. The average bright nickel plate depends largely on the plater who, rather than worry about current density and thickness, looks for good coverage, good color and smooth level deposits. These are extremely important in the jewelry business. Low current densities generally between 10-20 amp/sq ft are used since better coverage is utilized in the hard-to-plate recesses. The jewelry plater has many of these problems since the articles being plated are of many varied and intricate designs, making the calculation of surface areas of the parts a difficult mathematical problem which not many platers can solve. Experience and good judgment are the bright nickel plater's best tools.

Nickel plating may be the final finish or parts may be given a gold color. At present, the Hamilton gold solution, which normally deposits 18K gold color, is most popular. On the average, 6 millionths of gold are deposited within 20-60 seconds time. If gold is not used, a rhodium flash is put on, the plating time averaging from 20-30 seconds. Some platers use a 50 per cent nitric-acid water solution to check and see if the parts have enough plated thicknesses of gold or rhodium. Parts are immersed for 1-2 minutes and if they do not tarnish it is assumed they have enough gold or rhodium. After plating, the parts are inspected, furnished with glass stones or other decorative materials and packed ready for shipment. Some of the better costume jewelry houses apply clear lacquer to their work after plating for extra protection. This is left to the discretion of the manufacturer.

RACKING

In general, manufacturing jewelers have their own plating shops; only a small minority do not. It can be said that bright nickel precedes all plating done with precious metals. The normal bright nickel tank will average around 200 gallons. A few installations use a 75-gallon tank; large companies average about 400 gallons per tank. Automation in bright nickel has not invaded the jewelry plating plant nor does it seem likely to in the near future. The multivariety of shapes and designs produced are constantly undergoing an annual change, consequently production methods and racking have to be revised to meet the changing styles.

Racking presents a nagging problem in the jewelry business. Difficulties are encountered in trying to determine how to make contact without showing any contact points. This is a critical problem because jewelry undergoes a constant minute scrutiny by all women and men. Whether

Tie pins racked and ready for electrocleaning

Sample case of finished articles.

they spend a great deal or a small amount, the article must be nearly perfect to meet the praises or criticisms of their friends. It is amazing that with all the non-uniformity of racking procedures used, which by all standards in bright nickel plating should not produce good uniform bright deposits, not only are smooth bright deposits obtained initially but they are produced repeatedly. For example, in plating of key chains or locket chains, 20 or 30 strands of different lengths are bunched together hung on a wire and bright nickel plated. The bright nickel solution manages to plate the innermost recesses of the chains with a good plate. This accomplishment is a credit to platers because jewelry is always on exhibition and all flaws and defects are easily noted. Although racking is a problem, it has not interfered with the quality or volume of the merchandise produced.

EFFECTS AND ADVANTAGES OF BRIGHT NICKEL PLATING

The bright nickel processes have at present cut manufacturing costs and given costume jewelry a more appealing finish. The plating time of the cold nickel was anywhere from 1-2 hours. The parts then had to be buffed which meant more nickel was being used and lost due to buffing.

Bright nickel has given the public a more tarnish-resistant article. Previously parts were plated directly with gold and rhodium to save the time and costs of buffing operations on the plated cold nickel. Even for hard-to-reach recesses, a bright plate is available. Today pure sterling silver articles are being bright nickel plated for tarnish resistance. Then, after nickel plating, they are rhodium plated so as to achieve a normal silver color with good tarnish resistance.

CONTROL OF BRIGHT NICKEL SOLUTION

The control of the bright nickel solution is extremely important and should be maintained consistently by a plant chemist, a plating foreman, or the individual who operates the bright nickel bath since he should understand its performance.

The actual control of the solution does not require a technically trained individual, but the plater or person selected for the tank should be skilled in the use of the Hull Cell. With proper use of the Hull Cell, an experienced plater can control the solution to operate smoothly and consistently.

With the Hull Cell, the analyst or plater can, within certain degrees, point out major troubles such as lack of brighteners, low salts concentration, metallic impurities and improper *p*H range for good brightness. In times of indecision, the Hull Cell is used for brightener additions when the amounts needed in the production solution are questionable. For the actual concentration of salts, the nickel solution should be analyzed for its constituents. Again, this does not require a chemically trained individual. Today, all plating supply houses maintain service laboratories and service engineers who operate mainly for the benefit of the platers who are not trained in bright nickel control. These services are normally free to customers.

Jobbers and buyers today demand a bright nickel undercoat on all their costume jewelry. The one disadvantage of bright nickel processes is that they require a little more care in control and operation than do the dull nickel solutions. An acceptable bright nickel should have a good lustrous color, should maintain its lustre at all thicknesses of plate, be ductile for after-forming operations and have good throwing power for hard-to-plate areas and recesses and some leveling which the writer believes is basically inherent in all bright nickels. The bright nickel solution has really given the costume jewelry industry a good foundation as can be seen by its ever-increasing business.

ACKNOWLEDGMENT

The writer wishes to thank Omer Jette of Attleboro Falls, Massachusetts for taking time to aid him and Peter G. Fradley, editor of American Jewelry Manufacturing, for supplying data on the history of jewelry manufacturing.

Eugene N. Castellano was born in Newark, New Jersey, in 1927. He received a BS degree in Chemistry from Seton Hall University in 1949 and attended Columbia University for graduate work in Chemical Education. He was analytical chemist for two years with the Mennen Co. and four years was with Bart Laboratories as research chemist and assistant to Doctor D. S. Carr. At present, Mr. Castellano is manager of the Bright Nickel Department of the Seymour Manufacturing Co., in charge of technical service, research and product development and production of organic nickel brighteners. He is a member of the New Haven Branch, AES and the Naugatuck Valley Industrial Management Club.

PRIZEWINNING PLATING PLANT LAYOUTS

Competition Held by England's Institute of Metal Finishing

The Institute of Metal Finishing of London, England, recently held a competition with the purpose of stimulating new ideas on the layout of plating plants. Through the kind permission of the Institute of Metal Finishing and the courtesy of the English publications, "Metal Industry" and "Industrial Finishing," it is possible for PLATING to present the winning entries.

The competition was open to members and student-members of the Institute who were under 35 years of age. The first prize was shared by P. Berger and R. S. Dean.

It was required that the candidates plan a metal finishing unit to be placed on a plot of ground 150 by 80 ft, bounded as shown in Fig. 1. Of the area, 30 by 80 ft were to be left for an open yard. Size of the tanks, quantity and types of barrels and the number of polishing lathes are given in Table I. Aside from the equipment, space was to be allowed for a laboratory, inspectors' and foremen's offices, washrooms, maintenance and storage.

It was to be considered that the plating shop was part of a parent factory which supplied management, an accounting office, a lunch room and its principal services. The department would, however, do outside job work. The plant should be assumed to be located in an industrial town with a soft water supply.

Mr. Berger envisioned a good plating shop as having these features:

(1) Adequate equipment should be provided to make each process sequence "work" efficiently in practice.

(2) The equipment should always be grouped in such a way as to necessitate a minimum of thought and physical effort on the part of the operators.

(3) There should be a definite and systematic "work flow" plan for each section, as well as for the shop as a whole.

(4) There should be room for operators to move about without being restricted by nooks and crannies, or by work lying about during intermediate processing stages.

(5) There should be plenty of rinse water.

(6) There should be plenty of D.C. power available.

(7) The shop should be easy to keep clean.

(8) In an instance such as this, where no specific limit on capital expenditure was imposed, it was considered that (within the bounds of functional requirements) the plant should be cheap per ton of potential

TABLE I

Vats (Two long cathode rods or equivalent work capacity)	Size (ft)	No. off
Nickel (Bright)	7 X 3 X 3	2
Nickel (Dull)	7 X 3 X 3	1
Copper (Cyanide)	7 X 3 X 3	1
Cadmium	7 X 3 X 3	2
Zinc (Dull)	7 X 3 X 3	1
Zinc (Bright)	7 X 3 X 3	1
Chrome (Decorative)	7 X 3 X 3	1
Tin	7 X 3 X 3	1
Chrome (Hard)	7 X 3 X 3	2

Barrel	Type	No. off
Nickel	Inclined	3
Zinc (Dull)	Inclined	2
Zinc (Bright)	Horizontal	1
Cadmium (Dull)	Horizontal	2
Cadmium (Bright)	Inclined	1
Tin	Inclined	1
Brass	Inclined	1
Copper	Inclined	2

Other Processes	
Polishing:	6 off double-ended lathes
Phosphating:	1 off tank 7 X 3 ft
Metal Coloring:	B.M.A. and Florentine.
Lacquering:	1 off Spray Booth 1 off Dip Tank 2 ft 6 in. X 1 ft 1 off Centrifuge

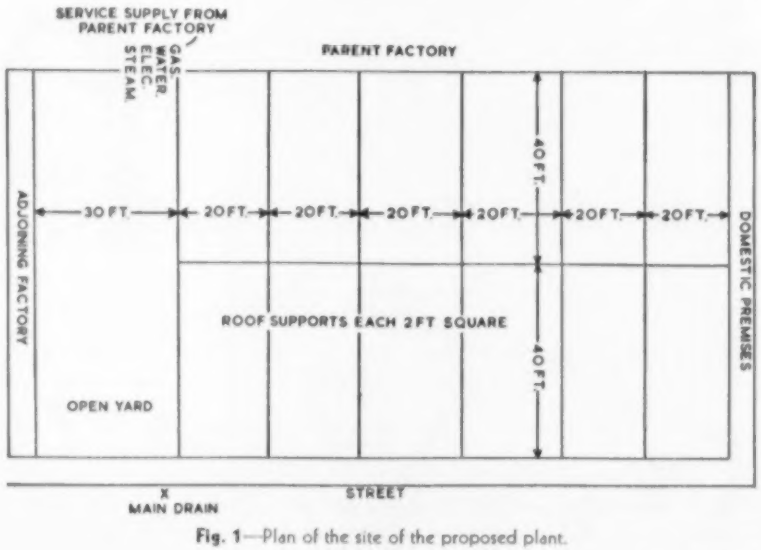
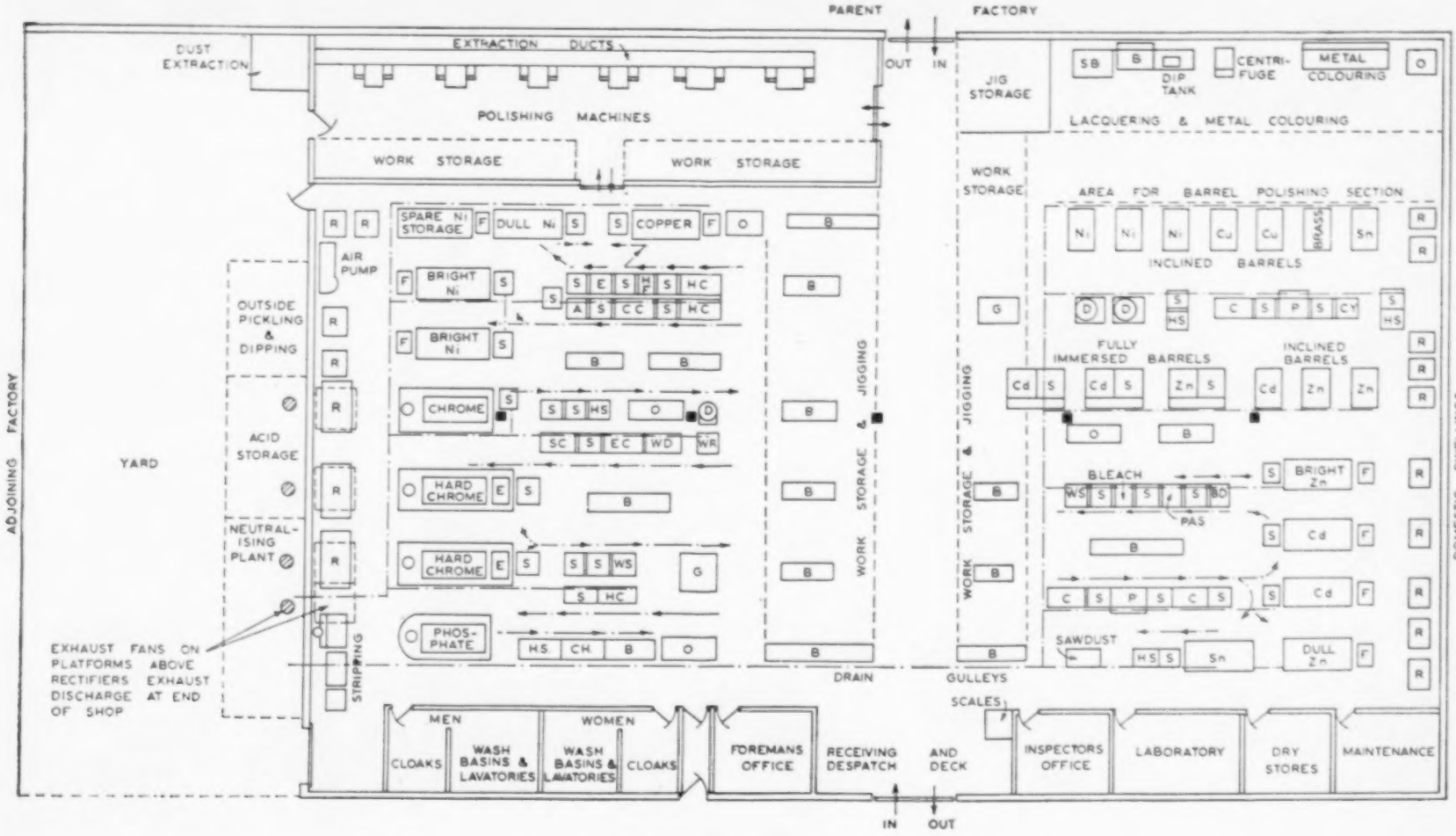


Fig. 1—Plan of the site of the proposed plant.



PLATING PLANT LAYOUT ENTERED BY R. S. DEAN

LEGEND

A —Acid
B —Bench
BD —Bright dip
C —Clean
CC—Cold cleaner
CH—Chromate
CY —Cyanide
D —Drier
E —Etch
EC —Electroclean
F —Filter
G —Degreaser
HC—Hot cleaner
HF —Hydrofluoric dip
HS —Hot swill
O —Oven
P —Pickle
PAS—Passivate
R —Rectifier
S —Swills
SB —Spray booth
SC —Scourer
WD —Wax dip
WR —Wax removal
WS —Warm swill
→→ Work flow
—·—·—Drain gullies
(Drain submerged under sangway)

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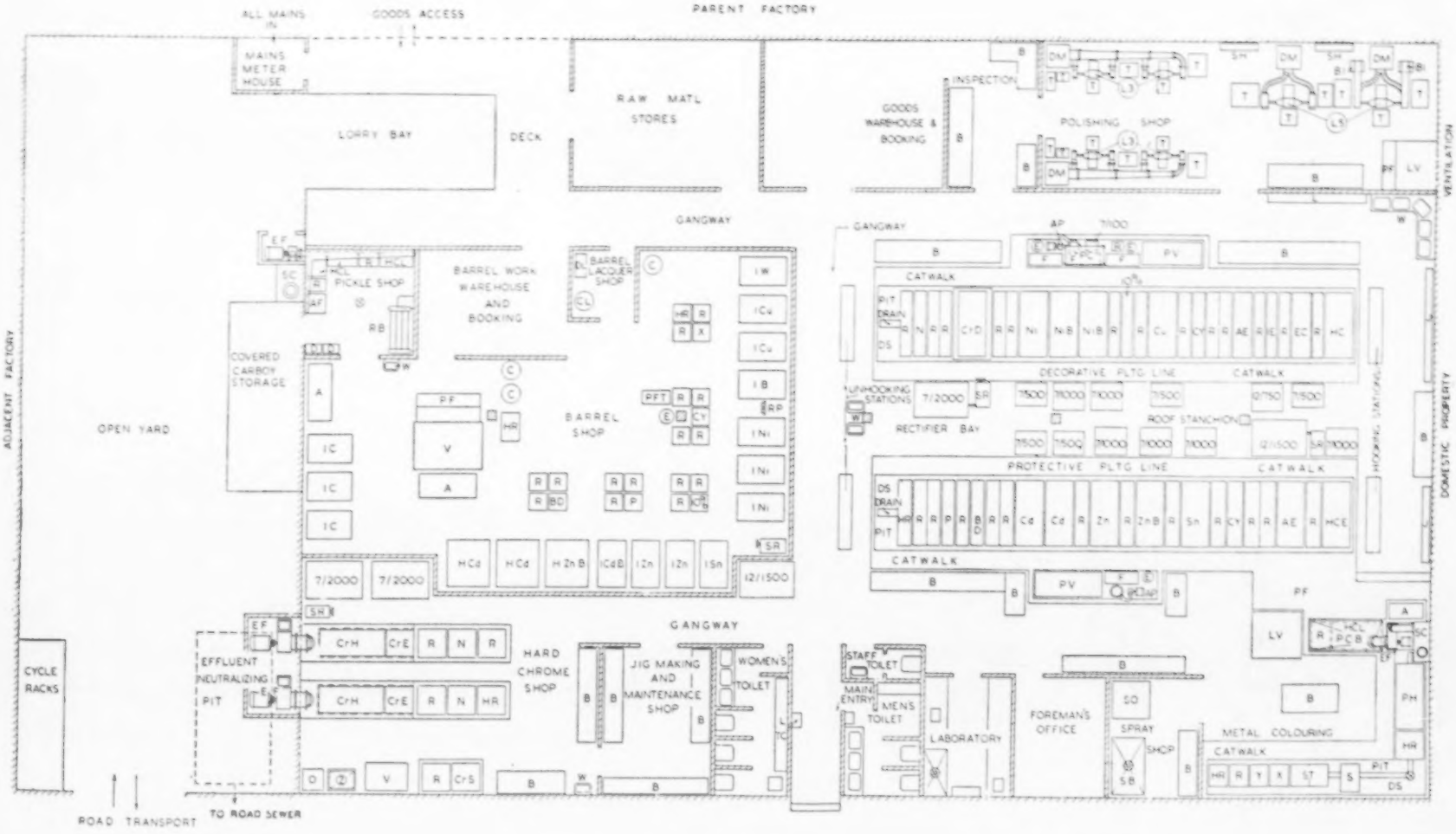
OCTOBER 1957



PLATING PLANT LAYOUT ENTERED BY P. BERGER

(The legend appears at the top of the opposite page)

LEGEND

PLAN ON OPPOSITE PAGE

A —Alkaline Storage for pickled work.
AE —Anodic Etch.
AF —Aquafortis Bright Dip.
AP —Rotary Air Pump Unit.
B —Bench.
BD —Bright Dip for Zinc, Cadmium.
BI —Backstand Idler.
C —Centrifugal Dryer.
Cd —Dull Cadmium Vat.
CL —Lacquering Centrifuge.
CrD —Decorative Chrome Vat.
CrE —Anodic Etch, Chromic Acid.
CrH —Hard Chrome Vat.
CrS —Chrome Stripper, alkaline.
Cu —Copper Vat.
CY —Sodium Cyanide Dip.
D —Dip Tank (misc.).
DL —Lacquer Dip Tank.
DM —"Dustmaster" No. 103 Extractor Unit.
DS —Draining Space.
E —Enameled Mixing Boiler.
EC —Cold Electro-Cleaner.
EF —Exhaust Fan.
F —Filter Press.
HC —Hot Soak Cleaner.
HCE —Hot Electro-Cleaner.
HCl —Hydrochloric Acid Pickle.
HCd —Horizontal Immersed Barrel/Rinse Unit., Cadmium.
HZnB—Horizontal Immersed Barrel/Rinse Unit, Bright Zinc.
HR —Hot Rinse.
IE —Immersion Etch for Zinc Diecastings.
IB —Motorized Inclined Barrel Unit, Brass.
IC —Motorized Inclined Barrel Unit, Cleaner.
ICdB —Motorized Inclined Barrel Unit, Bright Cadmium.
ICu —Motorized Inclined Barrel Unit, Copper.
INi —Motorized Inclined Barrel Unit, Nickel.
ISn —Motorized Inclined Barrel Unit, Tin.
IW —Motorized Inclined Barrel Unit, Water.
IZn —Motorized Inclined Barrel Unit, Zinc.
J —Jig Storage.
L —Lockers.
L3 —3 hp Polishing Lathe.
L5 —5 hp Polishing Lathe.
LV —Liquor/Vapor Degreaser.
N —Chrome Neutralizer
Ni —Dull Nickel Vat.
NiB —Bright Nickel Vat.
O —Oil Temper Bath.
P —Passivation Dip.
PC —Plating-out Cell.
PCB —Pickle Cabinet.
PF —Platform.
PFT —Portable Filter Unit.
PH —Phosphating Vat.
PV —Purification Vat.
R —Cold Rinse.
RB —Rumbling Barrel.
RP —Resistance Panel.
S —Sealing Vat.
SB —Spray Booth.
SC —Scrubber.
SH —Shelves.
Sn —Tin Vat.
SO —Stoving Oven.
SR —Stepless Regulator.
ST —Scouring Trough.
T —Table.
TC —Time Clock.
V —Vapor Degreaser.
W —Wash Basin.
X —Oxy-Copper Dip.
Y —Metal Coloring Dip.
Z —Canopied Wax Pot.
Zn —Dull Zinc Vat.
ZnB —Bright Zinc Vat.
10%x—10% Sulfuric Acid Dip. 7/500, 12/1500, etc. Oil immersed Rectifiers, 7 volt, 500 amp; 12 volt, 1500 amp. etc.

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output rather than cheap in purely figurative purchase price.

(9) Being largely a jobbing shop, the plant should be flexible enough to accommodate the variety of work likely to be encountered.

The Berger Plan

A thorough examination of Mr. Berger's layout will disclose he provided ample facilities for trucks to load and unload; warehouse and raw material storage are close by. The general flow of work through the plant is effected by an H-shaped gangway system. The pickling shop and hard chrome shop are on the yard side so the more noxious exhaust fumes would more easily be disposed of on that side. The acid-resistant floor slopes towards a central gully, draining into the neutralizing pit.

Mr. Berger summed-up some of the features of his layout as follows:

"The work flow system adopted for this layout is the return flow, since walking by operators will be reduced to a minimum, and also to avoid expense of work jig conveyors.

"In this layout, expense was reduced to the minimum requirements consistent with upkeep of full production from the specified plating tanks. No mechanical handling of jigs or workbars was considered necessary. Swill tanks were reduced to a minimum size to conserve water and thus reduce the amount of swill water passing through the effluent disposal plant. Two small tanks, using the cascade system of counterflow, are considered better than one large swill, but the size of the swill tank will depend on the maximum size of plating jig or article to be processed.

"Each section has been made self-contained by each having its own cleaning and swilling lines. Two trichlorethylene degreasers have been included in the complete set-up. Work is deposited either side of the gangway in the appropriate work storage area. Jigging and wiring benches are adjacent and work jigs are hung on rods convenient to the operator to collect.

"The three horizontal plating barrels included in the layout are fully immersed, each having its own swills and mechanically-assisted barrel changeover gear. Ten inclined barrels are scheduled for this section and it is suggested that circulating pumps be included for the returning of barrel solution to improve the overall efficiency of this section. Consideration should also be given to the use of barrels for polishing and burnishing, and an area has been allocated for this reason.

"The final layout is sufficiently versatile to meet any possible changes in the process sequence which may be required in the future, and sufficient room has been allowed to facilitate removal of tanks and other equipment for maintenance purposes."

The Dean Layout

In making his layout, Mr. Dean considered that one wall of the stipulated site bordered on private dwellings—noisy machinery and exhaust fans should be kept away from it.

Mr. Dean noted the "work entered from the parent factory and from the street" and "that a common point for receipt of goods from both sources is in the yard." But he chose a point about in the middle of the building, with an entrance to the parent plant on one side and a receiving and shipping deck on the street side, thus making it convenient for both the work being processed on the left-hand side and the right-hand side.

"The return flow system, where the process is split into two lines of tanks with a gangway between, is efficient, since the operator completes the cycle of operation by returning to the first process, states Mr. Dean's notes.

"'S' flow can be used for excessively long processes by splitting the tanks into three lines, and is useful where work flows through a shop from one end to the other. The disadvantage is that the empty plating jigs have to be transported back to the loading area.

"In this layout, expense was reduced to the minimum requirements consistent with upkeep of full production from the specified plating tanks. No mechanical handling of jigs or workbars was considered necessary. Swill tanks were reduced to a minimum size to conserve water and thus reduce the amount of swill water passing through the effluent disposal plant. Two small tanks, using the cascade system of counterflow, are considered better than one large swill.

"Each section has been made self-contained by each having its own cleaning and swilling lines. Two trichlorethylene degreasers have been included in the complete set-up. Work is deposited either side of the gangway in the appropriate work storage area.

"In the copper, nickel and chrome section, tanks are laid out in sequence for cleaning of steel, with the additional cleaner for brass work. An acid etch vat is conveniently positioned for steel work prior to dull nickel plating, and a separate cleaning line is provided for zinc-base alloys.

Drying Ovens

"Hot air drying ovens are included, since they are preferred to sawdust drying with a centrifuge for smaller work. A rotary air pump is included for the agitation of the solutions and separate filters are provided for each plating vat. Chrome tanks are exhausted by fans mounted on steel platforms situated over the rectifiers.

"For the zinc and cadmium sections, a single cleaning line to feed the five plating tanks is positioned so that either side can be worked by the operator.

"The three horizontal plating barrels included in the layout are fully immersed, each having its own swills and mechanically-assisted barrel changeover gear. Ten inclined barrels are scheduled for this section and it is suggested that circulating pumps be included for the returning of barrel solution to improve the overall efficiency of this section. Consideration should also be given to the use of barrels for polishing and burnishing, and an area has been allocated for this reason.

"A good floor to the plating shop is an expensive item. To reduce the initial cost by the use of cheaper flooring is not advisable. In this layout, blue bricks set in acid-resisting cement were advised, the flooring having the requisite slope to half-round chemical glazed pipes sloping towards the main drain."

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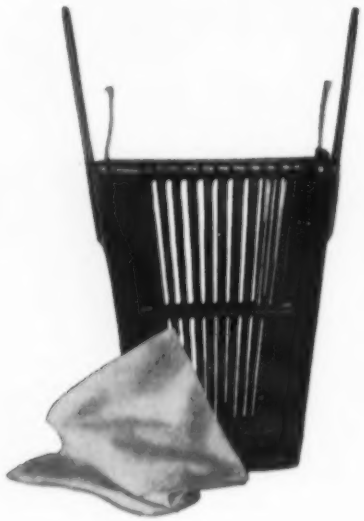

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DIMENSIONS AND PRICES

Length	Width Top	Width Bottom	Thickness	With Cotton Bag	With Nylon Bag
18	16½	12	3	$45.00	$51.00
24	18	12	3	50.00	57.00
30	19½	12	3	57.00	65.00
36	21	12	3	75.00	85.00

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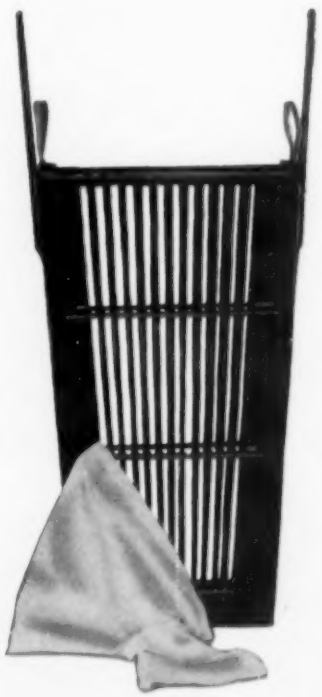

DIMENSIONS AND PRICES

Length	Width Top	Width Bottom	Thickness	With Cotton Bag	With Nylon Bag
36	17½	15	3	$65.00	$78.00
42	18	15	3	85.00	95.00
48	18½	15	3	95.00	105.00
60	19	15	3	120.00	135.00
72	20	15	3	145.00	157.00

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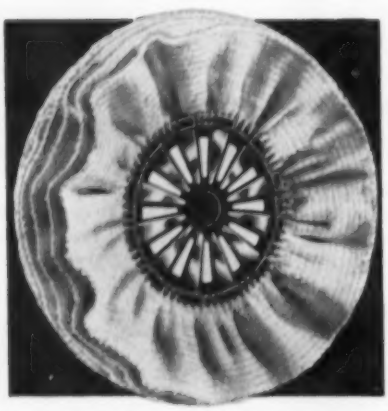
IMPORTANT
ANNOUNCEMENT

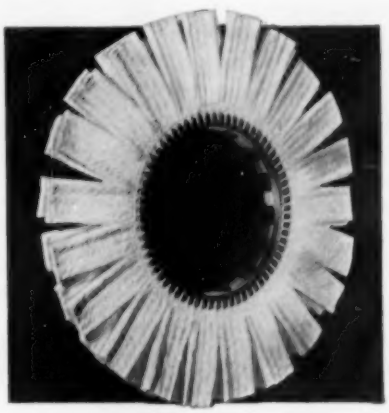
The *American Buff Company* announces the granting of patents by the United States to cover their new, improved Unit Sisal Buff and Open Face Combination Cloth and Sisal Bias Buff.



COMBINATION CLOTH and SISAL BIAS BUFF

United States Patent No. 2,803,097

- Gives the rapid coarse-cutting quality of a polishing wheel and the smooth luster-imparting ability of a soft cotton buff.
- Special construction prevents unravelling yet has the flexibility needed for irregular or contoured surfaces.
- Special design provides the ventilation required to prevent overheating.
- Multi-purpose construction makes substantial savings in time, labor and materials.



UNIT or FINGER SISAL BUFF

United States Patent No. 2,803,096

- Combines all of the desirable features of a cloth buff and a sisal buff.
- Gives high cutting rates with a finish of high luster and color.
- Extra flexible for fast cutting and finishing on irregular and contoured surfaces.
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Aerial view of Cincinnati, AES Convention City for 1958. Ohio River in the foreground.

OUTSTANDING 1958 CONVENTION IN PROSPECT

THE SHIFTING SCENE of Annual Conventions of the American Electroplaters' Society (AES) transposes the site of next Spring's annual assembly of the AES's membership family from Montreal, Canada's picturesque "Paris of the New World" which hosted the standout 1957 convention, to Cincinnati, a picturesque inland American city well-known and well-regarded for its convention facilities, attractions and for its hospitable spirit. And to enjoy that Ohio metropolis at its very best, the Cincinnati Convention will be held in mid-May 1958 (May 19–22 to be exact) instead of mid-June as customary.

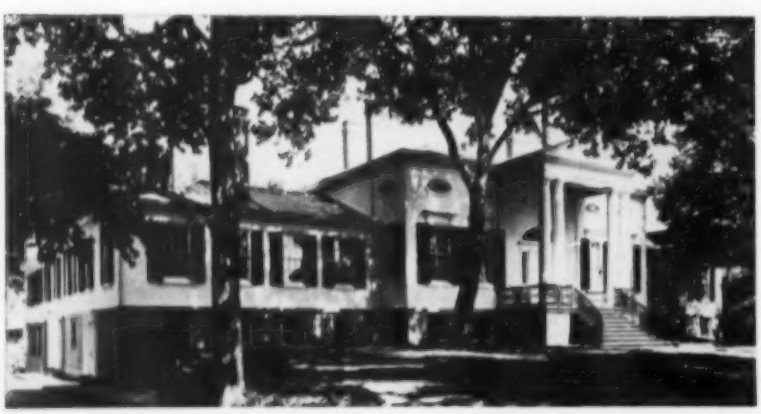
Apt is that 1958 Convention's slogan, "*Vas you efer in Zinzinnati?*," popularized at Montreal last June. Those who know the city, particularly those who attended and remember well the successful AES Convention held there over a third-of-a-century ago, are looking forward to next May's return. To the uninitiated, they and their families certainly have a happy and satisfying experience to anticipate.

Transformation on the "Beautiful Ohio"

Historically, the 1958 convention city is an old one, rich in tradition. The villages that eventually became today's City of Cincinnati were founded in 1788. Close to the banks of the Ohio River, they were surrounded by the seven hills over which Cincinnati mounted and spread as it expanded.

Martin Baum, a German, fathered some of the city's first industries. He launched a woolen mill, a flour mill, a foundry and a sugar refinery. To man them, he brought many immigrants from the East Coast. These hardy settlers gave Cincinnati an old-world air which adheres even today.

While most of the German and Irish immigrants who settled in the city during the mid 1800's have long since passed away, along with the inclines and the canal that once ran through the center of the city, their descendants and many of their characteristics remain. Fine German restaurants; open-air markets; several large German breweries; many traces of Rhineland ancestry still abound and contribute to the distinction of the Cincinnati local scene.



The renowned Taft Museum in Cincinnati.

Today's Culturally Wealthy Cincinnati

Today, downtown Cincinnati is a truly modern American city with two skyscrapers, the Carew Tower and the Union Central Building, dominating its skyline.

Distances are measured from Fountain Square, the center of the city's business district (convention headquarters are in the Sheraton-Gibson Hotel, which overlooks this square). The Tyler-Davidson Memorial Fountain that beautifies the square is a landmark of the city.

The city so well chosen by the AES family for its next annual convention is wealthy. Attractions include the Taft Museum, originally the home of one branch of the city's most famous family; the Cincinnati Museum of Na-

tural History; the Cincinnati Art Museum; Rookwood Pottery; the Krohn Conservatory; 140 parks; the Cincinnati Zoo; and the University of Cincinnati.

Culturally, Cincinnatians, among other distinctions, enjoy not only a nationally known symphony orchestra but also their vaunted May Festival of Music.

Baseball-minded Cincinnatians boast of and boost their National League pennant contender, the "Redlegs" with its array of power hitters. Major League night baseball, in fact, was launched in Cincinnati.

Collegiate football, basketball, professional hockey, horse racing, boxing, wrestling and auto racing provide abundant sports fare for other sports-minded residents or transients of this handsome Ohio city. The area also has one of the nation's finest amusement parks (Coney Island), numerous golf courses, riding stables, and pleasure boating on the beautiful Ohio River.

Within a short distance from the city are many historic sites and picturesque areas, including the world-famous Kentucky bluegrass country, with its beautiful race horse farms.

Cincinnati: Industrially Thriving and Growing

Industrial-wise, the 45th Annual AES Convention will be held within the heart of the nation's rich central industrial region. Forty per cent of the nation's pocketbook is within a 400-mile radius of the city. Cincinnati is the nearest major industrial city to the center of population. It is only 600 miles from New York, 240 from Detroit, 300 from Chicago, 700 from New Orleans and 350 from St. Louis. The city is called "The Gateway to the South."

Cincinnati's industries produce a wide range of industrial and consumer goods. Probably the largest basic industry in the city is the machine tool business. Prominent machine tool names having plants in Cincinnati include Cincinnati Milling Machine; LeBlond; Cincinnati-Bickford; Fosdick; Lodge and Shipley and others.

Other important products produced in the Queen City include soap (Procter & Gamble); electrical machinery; pumps; printing presses; laundry equipment; meat and other foods; books; printing inks; industrial chemicals; greeting cards; automotive parts (Ford and G. M. each have plants in or near the city), and jet engines.

Large plating installations in or near the city include Electric Auto-Lite Co.; the Wadsworth Div., Elgin National Watch Co.; Stolle Corp.; the Bendix Products Div., General Electric Co.; National Cash Register; General Motors and others.

Outstanding 1958 Convention in Prospect

Good transportation and central geographic location have made Cincinnati one of the "big ten" convention cities. Its industry, cultural attractions, amusement facilities and conveniences make it an interesting city to visit. These advantages combined with the excellent educational and entertainment programs now being planned by an enthusiastic Cincinnati Host Branch Convention Committee headed by Charles Wise as General Convention Chairman, point to an outstanding convention next year in May, during the city's most pleasant and inviting season.

"Vas you efer in Zinzinnati?" Whether the answer is "yah" or "nein," all AES roads will lead popularly there next May. Plan now to be among those present at the 45th Annual Convention, Sheraton-Gibson Hotel, May 19–22. Bring your family. *You'll be so glad you did!*

BRANCH LEADERSHIP
of the
45th ANNUAL CONVENTION
Cincinnati, Ohio
May 19-22, 1958

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ROBERT D. MILLER
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Secretary:
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(Upper) Cincinnati's Union Terminal. (Lower) Fountain Square, one of the most picturesque spots in downtown Cincinnati.

AES NEWS

Robert D. Miller presenting Cincinnati Convention Educational Sessions Program before recent Editorial Board meeting.

Cincinnati Convention Educational Program Gains Momentum

Momentum toward creating a widely appealing program of educational sessions for the 45th Annual Convention in Cincinnati, Ohio, next May 19–22 was accelerated by the Editorial Board by acceptance, at a recent meeting held at National Headquarters, Newark, of the program format submitted for Board consideration and action by Host Branch Educational Sessions Chairman Robert D. Miller in behalf of his industrious Cincinnati Convention Educational Sessions Committee.

The approved format embodies six half-day sessions spanning from Monday afternoon, May 19 through Wednesday, May 21, including dual sessions planned for Tuesday forenoon and afternoon, May 20. In addition, a panel session is being visualized for Thursday morning, May 22, as an innovation, at which practical plating problems can be analyzed with the help of a panel of experts. At this writing, no evening sessions are contemplated.

The Editorial Board reviewed the titles of the many technical papers that the Host Branch Educational Sessions Committee currently has under negotiation with authors for preparation subject to Editorial Board consideration and approval. It authorized the Host Branch Educational Chairman to invite these authors to submit abstracts for Board consideration at the Board's meeting to be held at the Statler Hotel, Detroit, Friday, December 6, 1957.

Those authors whose abstracts are tentatively approved by the Board at that Detroit meeting will be invited to finalize their papers in conformity with the Board's "AES Publishing Specifications for Authors" now in their possession. Reviewers will be assigned to such proposed papers at that meeting.

At the Board's Cincinnati meeting to be held in late February 1958, it will consider, select and approve papers to be delivered before the Cincinnati Convention, and authorize announcement of the final educational sessions program. Authors of papers not then selected will be cordially invited to submit them for PLATING publishing consideration.

The Board in Detroit, December 6, moreover, will not only consider and act upon the Cincinnati Educational Sessions Committee's recommendations for Session Chairmen but will also consider and act upon its proposal for a Panel Moderator and for at least a six-man panel for the proposed Panel Session, Thursday, May 22.

Beside many other PLATING and convention subjects considered and business transacted by the Board at its recent meeting at National Headquarters, Newark, it conducted a "critique" on the educational sessions held at the 44th Annual Convention in Montreal last June, led by G. Ross Davidson, Montreal Convention General Chairman.

Board members present at that Newark meeting were Donald C. Austin, Dr. Abner Brenner, John B. Capuano, G. Ross Davidson, S. Lewis Doughty, Dr. Abraham M. Max, Robert D. Miller and William M. Tucker. Chairman John P. Nichols presided and Rodney Leeds served as Secretary. Mr. Miller, William B. Stephenson Jr., his Co-Chairman, and their entire Cincinnati Educational Sessions Committee were commended for a creditable preparatory job done to date.

New Achievement Award Being Harnessed

Steps, in prescribed sequence, are being taken to inaugurate the AES's new "Scientific Achievement Award" intended to recognize each year, that member of the Society whose outstanding contributions have advanced the theory and practice of electroplating, metal finishing and allied arts; have raised the quality of processes and products; or have enhanced the dignity and status of the profession.

Through its three accredited Delegates to the Supreme Society, each of the AES's 56 current Branches have now been polled by John P. Nichols, Executive Secretary, for their first and second choices for this new signal Society honor. Branch nominations and dossiers are due in the Executive Secretary's hands by not later than October 15,1957. By November 1, these, in turn, will be channeled to the new "AES Scientific Achievement Award Committee", now in process of appointment, that will make the final selection and announce the winner at the Cincinnati Convention next May.

That winner, first to be thus honored since the Award was instituted by the Supreme Society in Montreal last June, will deliver the first "William Blum Lecture" at the AES's "Golden Jubilee Convention and International Exposition" in Detroit in June 1959. He will receive a $500 honorarium and a handsome scroll. His paper will be published in the 1959 Edition of "Technical Processings" and will head the list of "William Blum Lecturers" that will thereafter be published annually in that book. Having honored the profession by his technical contributions over at least a ten-year span, he will thus be honored by a grateful Society in reciprocation.

Plans for this new AES Award approved by the Supreme Society in Montreal on June 20, 1957 were perfected by a special presidential committee headed by Past President Kenneth M. Huston and composed of Myron B. Diggin; Dr. Charles L. Faust; Dr. Walter R. Meyer; Cleveland F. Nixon and Dr. Louis Weisberg.

Mrs. George Byron Hogaboom Deceased

The electroplating and metal finishing industry was saddened by the death on Tuesday, September 3 of Mrs. Emma G. Hogaboom, well-known and esteemed wife of the late George B. Hogaboom, a founding father of the American Electroplaters' Society, its initial first vice president and for many years, one of the Society's most indefatigable leaders. Mrs. Hogaboom expired nearly four years after the passing of her husband on New Year's Eve in 1953.

A member of both the Hartford and Newark Branches; author, with Dr. William Blum, of the book, "Principles of Electroplating and Electroforming;" much in demand as speaker by the AES at both national and Branch levels, the late Mr. Hogaboom was a familiar figure in Society circles during much of his business lifetime. Mrs. Hogaboom was frequently by his side at such events, consequently amassing many Society friendships.

A native of Meriden, Conn., Mrs. Hogaboom has resided in New Britain since 1914. A member of the South Congregational Church and a former school teacher, she was affiliated with the Martha Chapter, OES, Amaranth Lodge and the Sunshine Society.

Official representative of the plating industry and of the American Electroplaters' Society at the funeral held at the South Congregational Church, New Britain, Thursday, September 5, was Past President Arthur W. Logozzo. The Hartford Branch was well represented.

Mrs. Hogaboom is survived by her sons Ovide G. Hogaboom of Newington, Connecticut, and G. B. Hogaboom Jr. of Kenilworth, N. J.; by her daughter, Mrs. Charles N. Crockett of Manchester, Connecticut, and by five grandchildren.

Southeastern Branch Plans Annual Technical Session

The Southeastern Branch of the AES is staging the third Annual Technical Session the early part of next year. This Technical Session will take place at the Dinkler Plaza Hotel in Atlanta, Georgia, February 14 and 15.

Joseph G. Sterling

Joseph G. Sterling, secretary-treasurer of the Louisville Branch, AES, died on August 23.

He was associated with the plating business, mostly as a foreman, for 35 years. He was widely known by electroplaters and suppliers alike.

His career in plating started in 1922 at Hotpoint, Inc., Chicago. After several years, he transferred to the Bridgeport, Conn., plant of General Electric Co. Most recently, he was employed at the Appliance Park plant of the General Electric Co. in Louisville, Kentucky.

After moving to Louisville, he had been active in the local Branch activities. Specifically, he served as secretary-treasurer for the past five years and was instrumental in strengthening the young Branch. While located at Bridgeport, he served as secretary-treasurer of its Branch for 17 years.

In paying tribute to Mr. Sterling, John S. Houston, president, Louisville Branch, states, "Although our association with Joe has been relatively short, we have always found his sage advice very valuable. His many friends and admirers will deeply regret his passing."

Speakers Announced for Philadelphia's Educational Session

The new Sheraton Hotel in Philadelphia will be the scene of the Annual Educational Session of Philadelphia Branch, AES, on Saturday, November 2, starting at 2 p.m.

Papers will be presented by Dr. George P. Swift, consultant and AES past president; Marianno Ranno, Imperial Plating Co.; and Dr. D. Gardner Foulke, Hanson-Van Winkle-Munning Co.

The event will be climaxed in the evening by the customary reception, banquet, show and dance.

AES NATIONAL HEADQUARTERS PERSONNEL

KATHLEEN M. KILBRIDE

In charge of PLATING subscriptions and circulation, Miss Kilbride's supplementary duties also include book orders and distribution.

Frederick Gumm

Frederick Gumm of Bloomfield, New Jersey, founder and president of Frederick Gumm Chemical Co. Inc., died September 12 of pneumonia at Clara Maass Hospital, Newark, N. J. He was 66.

Mr. Gumm was a native of Hoboken, N. J. Upon finishing school in 1908, he entered the electroplating industry with the William Schimper Co. He later was associated with Diehl Motor Co. and National Carbon Co. In 1929, he formed the Hesse and Gumm Co.

The Frederick Gumm Chemical Co. Inc., was formed in 1932 in partnership with C. R. Percival and shortly thereafter, Oliver J. Sizelove joined the company.

Mr. Gumm was active in the electroplating industry for just short of a half century and his passing will be a loss to many of the elder generation of platers. As a business man, he was energetic and a hard worker. He had a warm affection for his friends; and found delight in helping men he trusted and liked. He was well known and active for many years in the American Electroplaters' Society and the International Fellowship Club.

He was a member of Alamania Lodge, F&AM, of Jersey City, Salaam Temple of Newark, the Forest Hill Field Club of Bloomfield, the Knoll Country Club of Boonton, Rockaway River Country Club, Denville, the B.P.O.E. and the Army Ordnance Association.

Mr. Gumm leaves his wife, Mrs. Nellie Swick Gumm; a son, John Gumm; a daughter, Mrs. Ruth Sizelove; two sisters, a brother and four grandchildren.

Correction

In the paper, "Water . . . A Global Problem for Electroplaters," by David Milne and Dr. D. Gardner Foulke published in the August 1957 issue of PLATING, the word "month" should have been "day" both times it appeared in the last sentence on page 859.

The corrected sentence should be: In one small plant of General Motors Corporation a drop in water consumption from a total of 1,337,000 gallons per day in 1955 to 786,000 gallons per day in 1956 was achieved by careful re-engineering of the water supply to plating installations.

INTERSOCIETY NEWS

Alfred T. Marinaro

Marinaro New MEPA Executive Secretary

Alfred T. Marinaro, 39, has been named executive secretary of the Masters' Electro-Plating Association of New York to fill the vacancy created by the death of Silvio C. Taormina in June. This announcement was made by Sal Novelli, chairman of the MEPA, following the screening of several candidates for the position.

The new MEPA executive secretary entered the metal finishing field in 1947 when he joined Platers Research Corp., New York, as vice president. Previously, he was production supervisor at Shawinigan Resins Corp., division of Monsanto Chemical Corp., Springfield, Mass. Mr. Marinaro is now managing director of Platers' Technical Service, Inc. and Platers' Research Corp., of New York and Chicago. A graduate of the Newark College of Engineering, he received his BS and MS in ChE from Columbia University in the early 1940's.

He holds several patents in the plastics field and more recently was issued patents in the electroplating of gold and gold alloys. He is a member of the American Institute of Chemical Engineers and the American Chemical Society.

Mr. Marinaro is married and resides at Verona, New Jersey, with his wife and three children.

Dates Set for NACE Conference

Three symposia and an educational lecture scheduled originally to be held on the afternoon of March 18, 1958 have been moved to Monday afternoon during the 14th Annual Conference of the National Association of Corrosion Engineers. The conference, to be held in San Francisco's Civic Auditorium March 17–21, includes 17 symposia and two round table discussions.

The Tuesday afternoon freed by the transfer will be allocated to visiting the annual exhibition, which is concurrent with the conference. The exhibition also will be closed at 5:30 p.m., Thursday, March 20, a half day sooner than has been the custom.

This change in scheduling will make early registration important. A number of technical committee meetings have been scheduled for the opening day of the conference.

Metals Division to Meet at Metallurgical Congress

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Association will be in session during the Second World Metallurgical Congress to be held in Chicago November 6, 7 and 8, 1957. A library display booth and information center will be available at the International Amphitheater.

Speakers from England, France and Germany as well as from the United States and Canada will be on the program.

Tours have been arranged through Armour Research Foundation Laboratories, International Harvester's New Research Center, and several other research organizations in the Chicago area. A tour of The John Crerar Library, the largest technical library in the world, can be included.

Plant Maintenance Show To Feature Pollution Elimination

The 1958 Plant Maintenance and Engineering Show, which returns to Chicago for the first time in three years next January, is expected to be the largest in its history.

The show is scheduled for the International Amphitheatre, January 27 to 30, inclusive, with the annual Plant Maintenance and Engineering Conference set for the same week.

Exhibit space already assigned indicates that the show will be about 50 per cent larger than the last time it was staged in Chicago. About 425 companies are expected to exhibit.

One of the important new aspects of both the show and the conference will be the presentation of methods and equipment to eliminate pollution of air and water, both within and outside plants. The pollution problem is one of the most troublesome to both industry itself and the communities where plants are located.

Standardization Seminar in San Francisco

A five-day seminar on industrial standardization will be held at the St. Francis Hotel, San Francisco, November 18–22, 1957, by Dr. John Gaillard, management counsel.

Dr. Gaillard was formerly a member of the staff of the American Standards Association and a lecturer at Columbia University. He was the 1954 recipient of the ASA's gold Standards Medal award "for leadership in the development and application of voluntary standards."

The primary objective of the Gaillard Seminar is to assist top management in setting up a standards organization in a company, developing a procedure and program for handling the work, and training staff men in the functions of the standards engineer, including the art of writing specifications.

Opportunity to Authors

Authors of technical and scientific papers on electroplating, metal finishing and related arts are cordially invited to submit manuscripts of original, unpublished papers to the Editor of PLATING for review and publishing consideration.

Any such paper accepted and published in PLATING will also become eligible, of course, for selection by the Society's PAPER AWARDS COMMITTEE for the Carl E. Heussner Award, George B. Hogaboom Award, AES Bronze Medal Award, Robert S. Leather Award, Chromium Plating Award or the Precious Metal Plating Award.

Though the submission of any such papers by AES members or non-members will be welcomed by PLATING any time during the year, this current period is particularly recommended. So as to expedite review and other processing, please write the Editor, PLATING, 445 Broad Street, Newark 2, New Jersey, for full particulars before submitting your manuscript.

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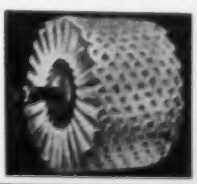

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PATENT ABSTRACTS

DR. D. GARDNER FOULKE
Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co
Matawan, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,785,091, March 12, 1957—Protecting Metal Surfaces—C. Rex, Hoboken, N. J.

Oxidizable metals may be protected by a composition of matter consisting of 20–50 per cent sodium metaborate, 20–40 per cent plastic clay and 5–40 per cent of at least one metal oxide.

12 claims.

No. 2,785,098, March 12, 1957—Treating of Aluminum—G. Cunningham and M. Levitin, assignors to Horizons Incorporated, Cleveland, Ohio.

Anodic coatings on aluminum with increased corrosion resistance and good light fastness are obtained if after anodizing a metal-organic compound is deposited in the pores of the oxide. Compounds used are metal alcoholates and tetra borohydrides with the formula $X\,[B\,(OR)_4]$ where $R = CH_3$ and C_2H_5. X is a metal and n is an integer. The metal-organic compound is hydrolyzed in the aluminum oxide pores to leave behind a metal compound while the alcohol volatilizes. The surface is finally sealed in hot water.

4 claims.

No. 2,785,117, March 12, 1957—High Speed Copper Cyanide Plating—M. Ceresa and R. Woehrle, assignors to Westinghouse Electric Corp., East Pittsburgh, Pa.

A bath for high speed copper plating is described as consisting of 8–15 oz/gal of copper as the cyanide, and at least 1 oz/gal of lithium hydroxide to provide a *p*H of at least 12, along with sufficient lithium cyanide to complex the copper cyanide plus 0.5 to 2 oz/gal of free lithium cyanide.

6 claims.

No. 2,785,516, March 19, 1957—Buffing Wheel Hub—F. Hendrickson, assignor to Norton Co., Troy, N. Y.

A buffing wheel hub assembly for mounting buffing elements in staggered relation circumferentially of the hub, comprising spaced end members adapted to be mounted on and rotate with a shaft, one of said end members having a plurality of openings arranged in a circumferential series, a plurality of buffing element mounting bars secured to the other end member and arranged in alignment with and complementally shaped to slide through said openings in the one end member to provide a longitudinally adjustable hub, and a plurality of spacer supports for and spaced along said bars between the end members, said spacer supports having a body portion with radially extending and circumferentially spaced fingers having mounting bars openings therein, the fingers of each spacer support embracing alternate mounting bars, and the fingers of one spacer support embracing different bars than an adjacent spacer support whereby a buffing element mounted on one bar extends across a spacer support embracing an adjacent bar.

4 claims.

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No. 2,785,957, March 19, 1957—Regeneration of Pickling Liquor—D. Ruthner, Vienna, Austria.

Ferrous sulfate is thrown down as a slurry by concentration (evaporation of water) of the acid, then hydrogen chloride is fed to the spent pickle liquor to transform the ferrous sulfate to the chloride. The ferrous chloride is heated to transform to iron oxide and hydrogen chloride which is used over again. See also No. 2,785,999 with 15 claims.

12 claims.

No. 2,785,997, March 19, 1957—Gas Plating Process—P. Marvin, assignor to Commonwealth Engineering Co. Dayton, Ohio.

A method for metalizing grooves in bodies consists of heating the grooves only then bringing into contact with a gaseous metal bearing compound which is heat decomposable.

6 claims, figure.

No. 2,786,002, March 19, 1957—Treating Zinc Ferrous Surfaces—L. Van and A. Douty, assignors to American Chemical Paint Co., Ambler, Pa.

The zinc surface is passivated by treating it with an aqueous acidulated solution in grams per liter consisting of:

Hexavalent chromium as CrO_3—20–90.

Chloride as NaCl—0.25 of CrO_3 to not more than twice the CrO_3.

Complex fluoride as fluorine—not less than 0.4.

The *p*H is given as 1.9–2.8 and the operating temperature is 160°–195° F.

8 claims.

No. 2,786,021, March 19, 1957—Method for Corrosion Rate of Metals—G. Marsh, assignor to The Pure Oil Co., Chicago, Ill.

To determine the electrochemical corrosion rate of metals pass an instantaneous direct current discharge sufficient in amount to effect measurable polarization through a specific circuit and measure the potential difference between two electrodes during depolarization of said electrodes.

7 claims, figure.

No. 2,786,022, March 19, 1957—Production of Acetylene Carboxylic Acid—V. Wolf, Hamburg, Germany.

Acetylene alcohol is oxidized in a sulfuric acid solution with lead dioxide anodes below 20° C.

2 claims.

No. 2,786,063, March 19, 1957—Electrolytic Cells—C. Deprez, assignor to Solvay and Cie, Brussels, Belgium.

A horizontal type electrolytic cell for the electrolysis of solutions is described. See also No. 2,786,810 (March 26) assigned to Dominion Tar and Chemical Co., Quebec, Canada, with 3 claims and figure.

4 claims, figure.

No. 2,786,266, March 26, 1957—Clad Fabrication—R. Fayles, assignor to Lukens Steel Co., Coatesville, Pa.

Pieces to be clad are painted with a nickel paint (powdered nickel and suitable vehicle), tack welded to align, heated in a controlled atmosphere, then pressed together. See also No. 2,786,265, assigned to same company for cladding with titanium, with 8 claims and figure.

1 claim, figure.

No. 2,786,308, March 26, 1957—Article Burnishing Means—C. Kinker, assignor to Gerity-Michigan Corp., Adrian, Mich.

The burnishing machine has an elongated tank with provision for moving the work along while wetting with a burnishing liquid and into contact with rotating burnishing mats.

5 claims, figure.

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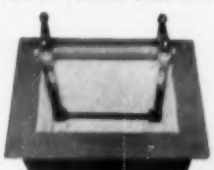

Nocordal "U" Coils. These immersion units are also available in "L" shape and bayonet style.

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■ Wherever corrosive fumes must be handled, Agilide (PVC) or Agilene (polyethylene) exhaust and ventilating systems will do the job at far less cost. Made entirely of rigid and durable plastic, they afford complete protection from corrosion. There are no coatings to chip or peel — no weak spots and no metal parts to corrode.

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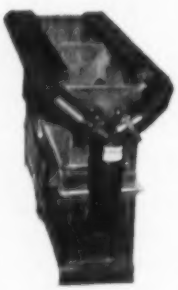

Double lateral exhaust ducting of 6⅝" O.D. Agilene material, all welded construction to be attached to duct line. 30" diameter stock sections for exhaust system.

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No. 2,786,779, March 26, 1957—Powdered Metal Deposition—A. Long, et. al., assignors to Dewrance and Co., Ltd., London, England.

Deposition is done with a gun using a combustible gas and a combustion supporting gas under controlled conditions.

13 claims, figure.

No. 2,786,780, March 26, 1957—Coating Process for Polyethylene—W. Wallis and H. Hahn, assignors to Dow Chemical Co., Midland, Mich.

To coat polyethylene with a tripolymer of vinylidene chloride, acrylonitrile and a functionally acidic ethenoid monomer, first sulfonate the polyethylene surface, then treat with a polybasic material having at least two amine groups. See also No. 2,786,783, assigned to Dow Chemical Co. with 15 claims.

20 claims, figure.

No. 2,786,782, March 26, 1957—Enameling Ground Coat—H. Zimmerman, et. al., Dunbar, West Virginia.

The frit consists essentially of

	Weight Per Cent
Fe_2O_3	1–15
ZnO	0–9
SiO_2	30–45
B_2O_3	17–28
Na_2O or K_2O	11–22
CaO	3–8
Al_2O_3	0–7

14 claims.

No. 2,786,807, March 26, 1957—Electrical Recording Medium—R. Schwartz, assignor to Faximile, Inc., N. Y.

A dry white recording medium consists of a single layer porous member impregnated with an electroresponsive substantially colorless marking compound, a highly ionizable salt, and a major quantity of an acetamide derivative $CH_{(3-n)}X_nCONH_2$ where x is CN, F, Cl, Br, I, and OH. The medium is rendered electroconductive and electrically markable when the impregnant is heated to the melting point.

6 claims.

No. 2,786,808, March 26, 1957—Production of Titanium—B. Raney, assignor to Chicago Development Corp., Riverdale, Maryland.

A periodically reversed unidirectional direct current is passed between two electrodes immersed in a molten halide bath.

7 claims, figure.

No. 2,786,809, March 26, 1957—Electrolytic Cladding—B. Raynes, assignor to Horizons Titanium Corp., Princeton, N. J.

A base metal may be clad with Ti, Zr, Ha, V, Ta, Nb, Mo, and W, from a fused salt bath containing a major amount of alkali metal or alkaline earth halide, 15–50 per cent of the double fluoride of the corrosion resistant metal and an alkali metal and ¼–10 per cent of water.

No. 2,787,565, April 2, 1957—Treatment of Metal Surfaces—E. dePretto, assignor to Societa per la Fosfatazione, Milan, Italy.

A phosphate treatment for iron, steel, zinc and cadmium is done in a bath consisting of 1–20 per cent of a liquid salt composition of: a metallic phosphate, a metallic nitrate, free phosphoric and nitric acids and a phosphoprotein.

8 claims.

No. 2,787,588, April 2, 1957—Chromium Plating—J. Stareck, assignor to Metal and Thermit Corp., N. Y.

Claim 1 states: A method of electrodepositing crack-free, chromium plate on a metal article which comprises essentially: passing current in the range of 0.5 to 8 amp/sq in from an anode

to said article as a cathode immersed in an aqueous chromium plating bath at a temperature of 140° F to the boiling point of the bath, said bath comprising essentially 300 to 900 g/l CrO_3, strontium sulfate and an alkali metal silicofluoride each in an amount sufficient to saturate said bath and to provide therein an undissolved residue of strontium sulfate and alkali metal silicofluoride, respectively, and a soluble non-catalytic alkali metal compound in an amount sufficient to suppress the concentration of the alkali metal silicofluoride in solution in said bath so that the sum of the dissolved sulfate (SO_4 =) and silicofluoride (SiF_6 =) is in the range of 2.5 to 10.5 g/l said alkali metal of the noncatalytic compound being the same as that of the alkali metal silicofluoride and being selected from the group consisting of sodium and potassium, said bath being free of compounds acting to suppress the concentration of dissolved sulfate, and said sum of dissolved sulfate and silicofluoride varying with the CrO_3 concentration in the manner defined by the area ABCD of the graph shown.

No. 2,787,589, April 2, 1957—Chromium Plating—J. Stareck, assignor to Metal and Thermit Corp., N. Y.

Claim 1 states: A method of electrodepositing crack-free, chromium plate on an article of metal which comprises essentially: passing current in the range of 0.5 to 8 amp/sq in from an anode to said article as a cathode immersed in an aqueous chromium plating bath at a temperature of 140° F to the boiling point of the bath, said bath comprising essentially 200 to 900 g/l CrO_3, at least one soluble sulfate-containing compound in an amount sufficient to produce a concentration of 0.3 to 5.5 g/l of dissolved sulfate (SO_4 =) and at least one soluble silicofluoride-containing compound in an amount sufficient to produce a concentration of 1.0 to 11.4 g/l of dissolved silicofluoride (SiF_6=), said bath being free of compounds acting to suppress the concentrations of dissolved sulfate and silicofluoride, the sum of said dissolved sulfate and silicofluoride being in the range of 1.5 to 11.7 g/l and said sum of dissolved sulfate and silicofluoride varying with the CrO_3 concentration in the manner defined by the area ABCD of the graph shown.

No. 2,787,590, April 2, 1957—Electroplating Bath Purification—E. Rinker, assignor to Sel-Rex Precious Metals, Inc., Belleville, N. J.

To remove carbonates in cyanide baths use a complex salt of the cyanides of barium and the metal to be plated. The complex is added to the bath in amounts sufficient to remove a substantial portion of the undesired anions without raising the free cyanide.

4 claims.

No. 2,787,969, April 9, 1957—Work Carrier Hook—J. Davis, assignor to Udylite Corp., Detroit, Mich.

Five figures and 8 claims describe a hook for use on a flat rail of a plating conveyor.

No. 2,788,289, April 9, 1957—Protective Coatings for Aluminum—N. Deuble, assignor to Climax Molybdenum Co., N. Y.

The molybdenum or molybdenum alloy article is immersed in a molten bath of aluminum and silicon for at least 15 minutes until diffusion between the bath and the molybdenum form a coating high in silicon and aluminum. Temperature of bath is below 2000° F, and the silicon content is 5 per cent to 25 per cent by weight. See also No. 2,788,290, by same inventor with 7 claims.

2 claims.

No. 2,788,292, April 9, 1957—Treating Chromium Surfaces—W. Giesker and Richard Britton, assignors to The Autotyre Company, Oakville, Conn.

(Continued on page 1127)

COMPLETE
• BRAZING
• ZINC PLATING
• FINISHING
SYSTEMS

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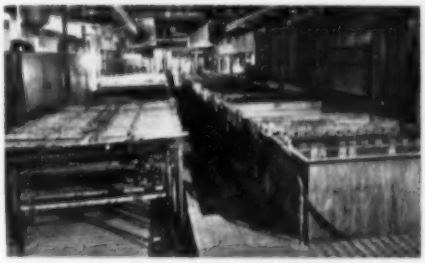

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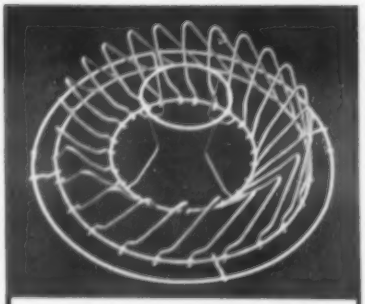

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COLD PROPERTIES	FLEXIBLE AT 65° F
LIGHT RESISTANCE	GOOD
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SCUFF RESISTANCE	VERY GOOD
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PROPOSED

Tentative Recommended Practice For

PREPARATION OF LEAD AND LEAD ALLOYS FOR ELECTROPLATING[1]

ASTM Designation: B-57T

Issued, 1957.[2]

This Tentative Recommended Practice has been approved by the sponsoring committee and accepted by the Society in accordance with established procedures, for use pending adoption as standard.

Scope

1. This recommended practice is intended to serve as a guide for the proper preparation for electroplating of all alloys wherein the major constituent is lead. Conditioning cycles include suitable procedures for applying electroplated finishes and coatings on ornamental giftware, costume jewelry, casket trim, hollow ware decorations, and for use in the stereotype printing industries.

Nature of Lead

2. (*a*) The tensile strength of lead and lead alloys ranges from 2000 to 5000 psi; therefore, the measured adhesion of electrodeposits cannot be greater than this value.

(*b*) Difficulties in applying high-quality electrodeposits to lead are due to the following properties of lead:

(*1*) The very active chemical nature of lead,

(*2*) The fact that lead forms insoluble salts with most acids used in pickling although these may be rinsed away if free fluoride is present,

(*3*) The diffusivity of lead with nonferrous metals, and

(*4*) The poor resistance to plastic surface deformation during polishing.

Process Precautions

3. The following process precautions should be observed:

(*a*) Precleaning of raw castings is sometimes necessary to remove mold parting compounds, surface oxides, and residue from deep areas which are never reached by polishing wheel or scratch brush operations (see Section 4).

(*b*) In cyanide plating solutions, the initial current density must be controlled and kept low enough so that no gassing occurs to cause poor adhesion. This is revealed as grouped blisters in the high current density areas of the electrodeposits.

(*c*) If a strike plate is used, it should be thick enough to prevent the next plating solution from attacking the basis lead. Because there are so many variables involved, no specific recommendations can be made.

(*d*) Preplate or intermediate deposits should be of substantial thickness so that complete alloying with the lead does not take place, an occurrence which causes poor adhesion of subsequent deposits. This defect is indicated by blistering after prolonged storage or after an accelerated aging test.

(*e*) The lead compounds formed by the reaction of most acids and alkalies used in plating are not water soluble and the precaution must be taken to remove these compounds to eliminate adhesion failure.

(*f*) Engraving of plated finishes on lead cannot be done on deposits over 0.0002 in. (5μ) as the plate will tear away from the lead at cross cuts. Engine turning by burnishing can be done on any thickness of deposits.

(*g*) Polishing and coloring of final plated films must be done at slow speeds, and with loose or cooled buffs to eliminate overheating and flowing of basis metal.

Precleaning

4. (*a*) Remove fins and parting lines by use of trimming dies or by scraping, filing, or grinding. Some machining may be done at this point, such as drilling holes, or milling or cutting slots, grooves, flats, or squared surfaces.

(*b*) Clean in alkaline, emulsion type or other standard cleaning material to remove surface soils.

(*c*) After rinsing, transfer the parts into one of the following pickles, the function of which is to remove surface oxides, die, or mold parting compounds:

(*1*) An aqueous solution containing 25 per cent by volume of 42 per cent fluoboric (HBF_4) acid with or without 6 fluid oz per gal (47 ml per liter) of 30 per cent hydrogen peroxide.

(*2*) An aqueous solution containing 8 per cent by volume of glacial acetic acid, and 4½ per cent by volume of 30 per cent hydrogen peroxide (80 ml per liter of glacial acetic acid, 45 ml per liter of 30 per cent hydrogen peroxide),

[1] Under the standardization procedure of the Society, this recommended practice is under the jurisdiction of the ASTM Committee B-8 on Electrodeposited Metallic Coatings.

[2] Accepted by the Society at the Annual Meeting, June, 1957.

[3] 1955 Book of ASTM Standards, Part 2.

[4] Where heavier deposits are desired, use of hydrochloric acid alone may not be desirable.

(*3*) An aqueous solution containing 5 per cent by volume of concentrated sulfuric acid (50 ml per liter) and 3 oz per gal (23 g per liter) of sodium or potassium fluoride.

(*4*) An aqueous solution containing 30 per cent by volume of concentrated hydrochloric acid (300 ml per liter) and 3 oz per gal (23 g per liter) of sodium or potassium fluoride.

NOTE.—These pickles should be held in tanks having suitable nonmetallic linings, and are normally used at room temperatures.

(*d*) After rinsing, an immersion in a water displacing, film-forming material is advantageous. Sometimes a neutral soap, oil, or synthetic emulsion film may be used according to the type of polishing compound that will be packed into the deep recesses. These materials are removed later.

Assembly of Parts

5. Precleaned parts then are ready for further assembly, such as soldering to other metals for ornamentation or mechanical reasons.

Polishing or Buffing

6. After parting lines, fins, and gate marks are removed, greaseless compounds on loose cloth wheels are used for rough smoothing followed by a soft leather, chamois, or sheepskin wheel operating at 3000 to 5000 surface feet per minute. These are used with white lime compounds of various grease concentrations. Cloth wheels can be used on highly ornamented parts, but not on any surface having a smooth area, as drag marks will occur.

Preparation for Plating

7. (*a*) *Precleaning.*—Solvent or solvent-alkali emulsion soak cleaners can be used if parts being plated can be rinsed easily and completely; otherwise alkaline, soap and ammonia, or wetting agent soaks should be used. Spray washing with alkaline or solvent type cleaners may be used prior to the electrocleaning cycle instead of soak cleaning.

(*b*) *Electrocleaning.*—Cathodic electrocleaning usually is used, especially for decorative bright finishes. Anodic electrocleaning dissolves the lead and is used sometimes in industrial or special applications if stressed or distorted surface layers must be removed to expose the natural understructure.

There are proprietary cleaners designed for special conditions; however, one made up using 3 oz per gal (23 g per liter) of Na_2CO_3 and 3 oz per gal (23 g per liter) of $Na_3PO_4{\cdot}12H_2O$ operated at 140 to 180 F (60 to 82 C) with 6 to 8 v with work cathodic for 30 sec to 1 min is advantageous. Hand cleaning by mopping and brushing is done, but the trend is away from hand operations.

(*c*) *Acid Pickle.*—An acid pickle that will remove all oxide residues and insoluble compounds left from cleaning is one containing a fluoride, such as:

(*1*) An aqueous solution containing 2 to 6 per cent by volume of 48 per cent hydrofluoric acid (use with extreme caution).

(*2*) See Section 4 (*c*) and (*d*).

(*3*) An aqueous solution containing 12 to 25 per cent by volume of 42 per cent by weight fluoboric acid is the most widely used and gives the best results on joined or soldered parts. See the Recommended Practice for Preparation of Copper and Copper-Base Alloys for Electroplating (ASTM Designation: B 281–53 T),[3] Sections 10 (*a*) and 11 (*a*) and (*b*).

Typical Cycles Used Successfully in Production

8. The following typical cycles were used successfully in production for the metals listed:

Stereotype Metal (80.5 to 84.0 per cent Lead, 11.3 to 13.2 per cent Antimony, 4.0 to 6.0 per cent Tin).

(*a*) *Preparation for Nickel or Iron Plating Stereotypes:*

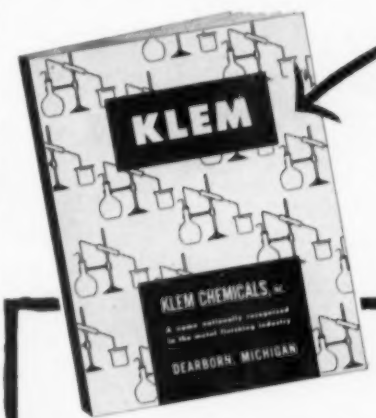
(*1*) Electroclean with the following solution:

Solution	8 to 12 oz per gal (60 to 90 g per liter) trisodium phosphate ($Na_3PO_4{\cdot}12H_2O$)
Temperature	100 F (38 C)
Voltage	6 v
Cathodic	3 to 4 min
Anodic	up to 10 sec
Current density	30 amp per sq ft (3.2 amp per sq dm)

(*2*) Cold water rinse and spray.

(*3*) Acid dip with the following solution:

Solution	25 per cent by volume of 42 per cent fluoboric acid (HBF_4)



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Temperature . . . room
Time . . . . . 10 to 15 sec

(*4*) Cold water rinse and spray.

(*5*) Nickel or iron plate, 0.0007 in. (17.8μ or 0.7 mil) thick.

(*b*) *Alternate Preparation for Iron Plating Stereotypes:*

(*1*) Stoddard solvent wash to remove proof printing ink.

(*2*) Electroclean cathodically (see Section 7 (*b*)).

(*3*) Scrub with tampico brush and cleaning solution used in Item (*2*).

(*4*) Thoroughly rinse.

(*5*) Acid dip (see Section 7 (*c*), Items (*1*), (*2*), and (*3*)).[4]

(*6*) Thoroughly rinse.

(*7*) Iron plate, 0.0007 in. (17.8μ or 0.7 mil) thick (Note).

NOTE.—The iron may be deposited from the following solution:

Ferrous ammonium sulfate ($FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$)	45 oz per gal (338 g per liter)
Boric acid (H_3BO_3)	5 oz per gal (38 g per liter)
*p*H	3.1 to 3.4 (adjusted with H_2SO_4)
Temperature	140 F
Current density	10 to 50 amp per sq ft

Ornamental, Decorative Ware, or Costume Jewelry

9. (*a*) *Preparation for Copper Striking:*

(*1*) Preclean and rinse (see Section 7 (*a*)).

(*2*) Electroclean (see Section 7 (*b*)).

(*3*) Rinse.

(*4*) Dip in acid (see Section 7 (*c*)), Items (*1*), (*2*), and (*3*)).[4]

(*5*) Rinse.

(*6*) Copper strike (see Appendix I, Section A2).

(*7*) Follow with other electrodeposits as required.

(*b*) *Preparation for Nickel Striking:*

(*1*) Preclean and rinse (see Section 7 (*a*)).

(*2*) Electroclean (see Section 7 (*b*)).

(*3*) Rinse.

(*4*) Dip in sodium cyanide, 4 to 6 oz per gal (30 to 45 g per liter).

(*5*) Rinse.

(*6*) Dip in acid (see Section 7 (*c*), Items (*1*), (*2*), and (*3*)).[4]

Plating Sept 460 Gal 229 8-175-10 H

(*7*) Rinse.

(*8*) Nickel strike (see Appendix I, Section A1).

(*c*) *Preparation for Copper or Nickel Plating:*

(*1*) Preclean and rinse (see Section 7 (*a*)).

(*2*) Electroclean (see Section 7 (*b*)).

(*3*) Rinse.

(*4*) Dip in acid (see Section 7 (*c*), Items (*1*), (*2*), and (*3*)[4].

(*5*) Rinse.

(*6*) Bright copper, nickel, or both, left in this finish or followed by another metal for color.

Small Parts

10. (*a*) *Preparation for Barrel Plating:*

(*1*) Remove heavy surface soil by vapor degreasing, alkaline soak cleaning, or solvent emulsion cleaning.

(*2*) Hot rinse.

(*3*) Alkaline soak clean, or electroclean (see Sections 6 (*b*)).

(*4*) Rinse.

(*5*) Dip in acid (see Section 6 (*c*), Items (*1*), (*2*), and (*3*))[4].

(*6*) Rinse.

(*7*) Copper strike (see Appendix I, Section A2).

(*8*) Follow with other electrodeposits as desired. Barrel burnishing, chemical coloring, relief treatment of oxidized layers, and lacquering may follow the above. There is equipment that allows the entire cycle to be done in barrels, also baskets may be used in all but the plating, burnishing, or relief-treatment steps.

• • •

APPENDIX

A1. *Nickel Strike:*

	g per liter	oz per gal
Nickel sulfate, $NiSO_4 \cdot 6H_2O$	120	16
Ammonium chloride, NH_4Cl	15	2
Boric acid, H_3BO_3	15	2
*p*H	5.2 to 5.4	
Temperature	68 to 86 F (20 to 30 C)	
Current density	.5 to 20 amp per sq ft (0.5 to 2 amp per sq dm)	

A2. *Copper Strike:*

	g per liter	oz per gal
Copper cyanide, CuCN	22.5	3
Sodium cyanide, NaCN	34	4.5
Sodium carbonate, Na_2CO_3	15	2
Total copper, Cu	16	2.1
Free cyanide, NaCN	7.5	1
*p*H	11.0 to 12.0	
Temperature	110 to 122 F (43.3 to 50 C)	
Current density	10 to 20 amp per sq ft (1 to 2 amp per sq dm) (initially lower to avoid gassing)	

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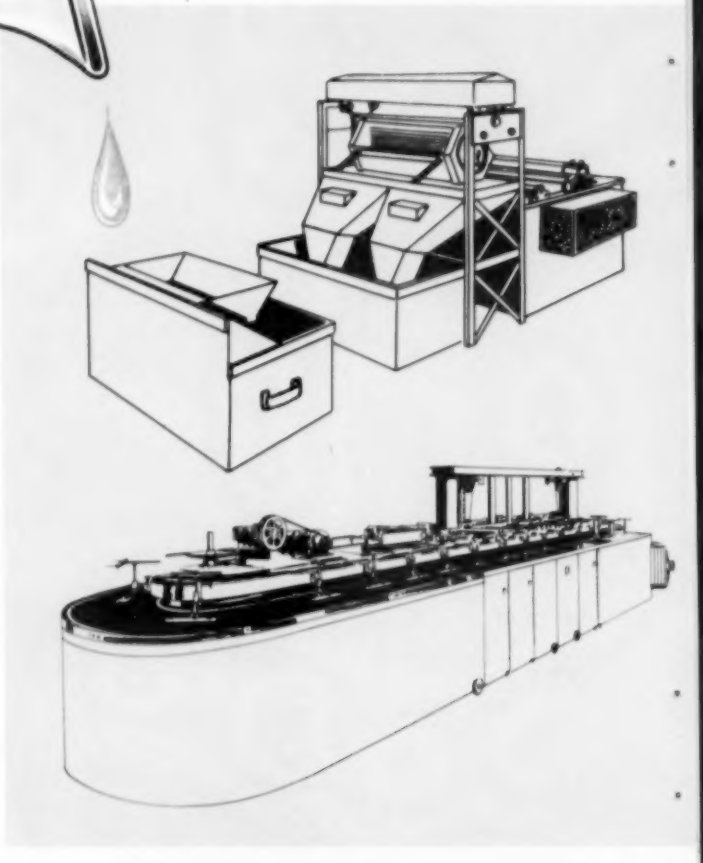

. . . while consistently producing a high speed, buffable, bright plate through the use of Lea Copper-Glo.

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How about your copper plating process? Can the same be said for it? Or is there a constant battle with contamination and constant uncertainty as to uniformity and quality of plate and even as to the length of the plating cycle?

You should investigate the use of Lea Copper-Glo in the Lea-Ronal Bright Copper Process. In all probability your present solution can be converted to this proved superior process. You can be confident that you can obtain this high tolerance to contaminants and the better plating in general that hundreds of plating shops and industrial plants are already enjoying in their cyanide copper plating.

In writing for the newly revised Copper-Glo technical manual, please describe fully your present problems and requirements.

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Orders for copies will be accepted and serviced by the American Electroplaters' Society on strictly a first-come, first-served basis so long as its limited supply lasts. The domestic cost of the book is $12.50 per copy including postage. To those ordering it from outside the United States' continental limits, the charge is $15 per copy including postage cost. All orders must be accompanied by payment in full to obviate unnecessary bookkeeping expense.

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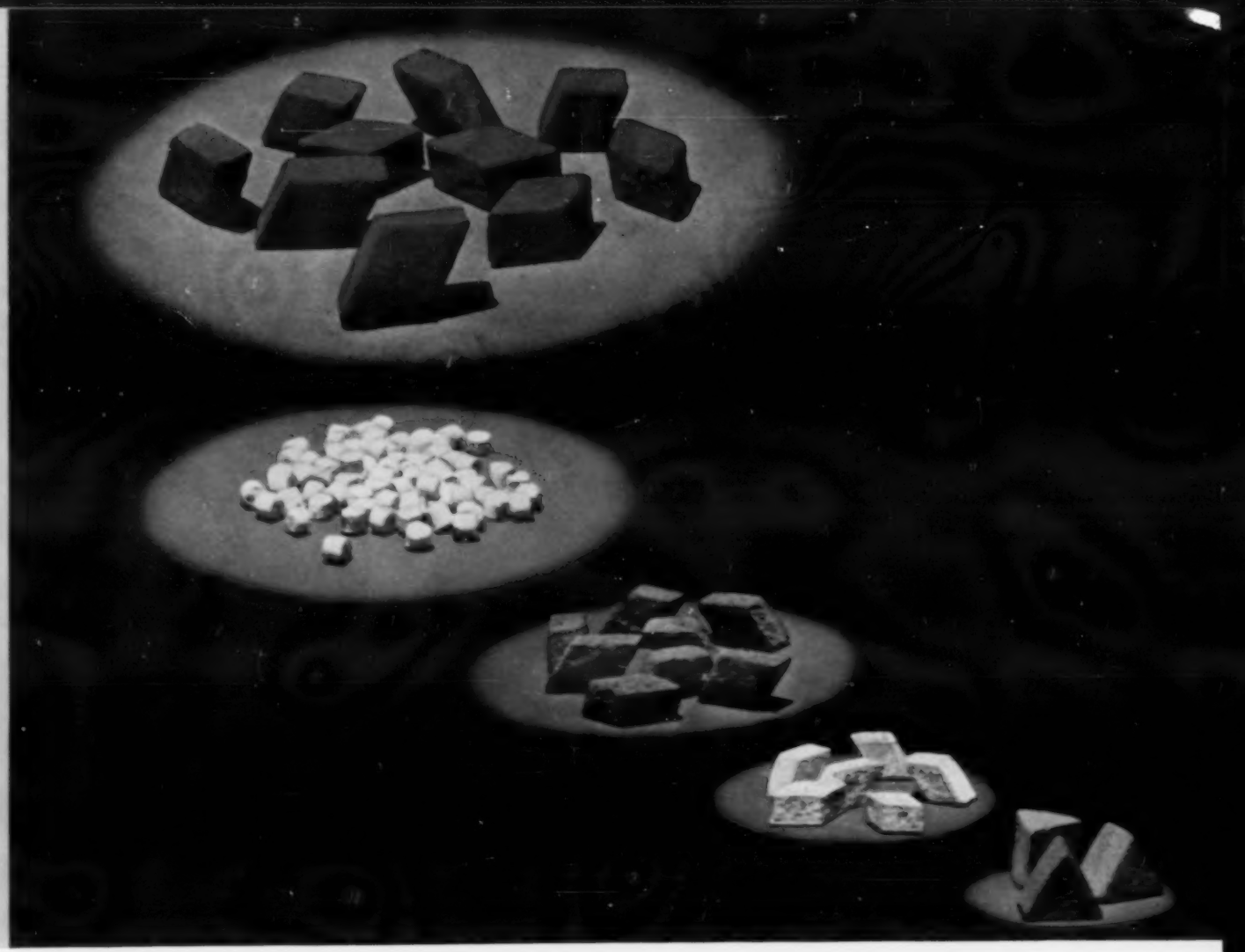

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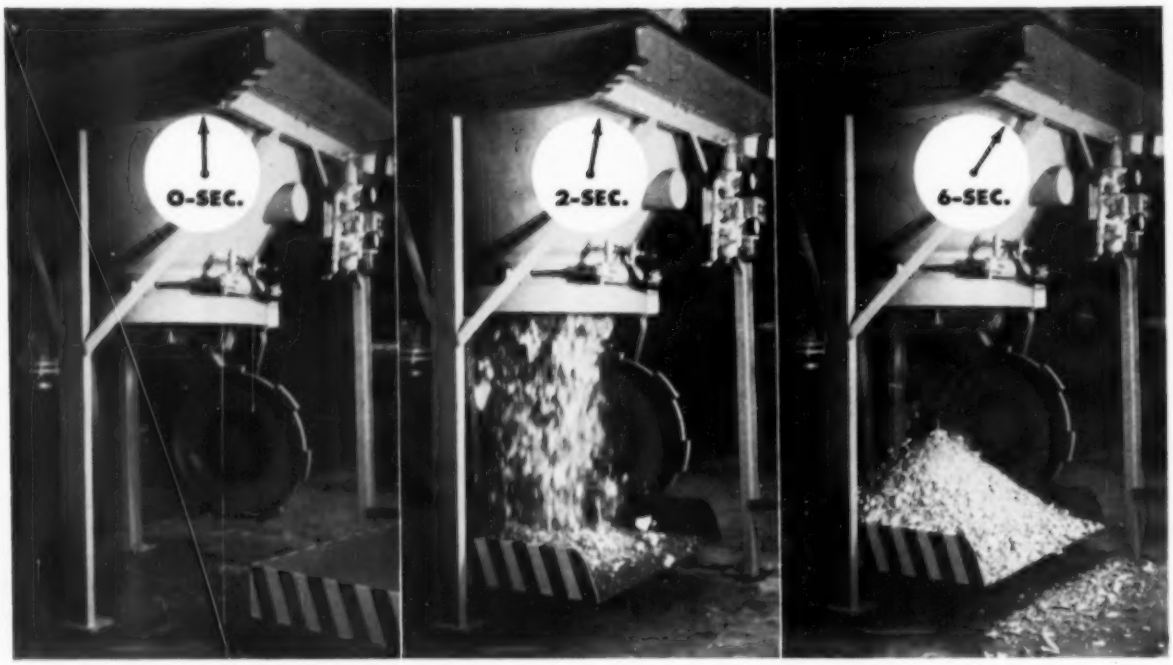

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New M&T bright cyanide copper – faster and more economical

Copper deposits now fit the need

Metal & Thermit now offers the most complete line of copper plating processes – has a deposit to meet all applications.

M&T "Golden Glow" Bronze is recommended for the optimum in speed, or throwing power to cover the most intricate work, or for a most attractive final finish. This is a copper-tin alloy process that is as easy to control as single metal plating.

Unichrome Pyrophosphate Copper stands out when density of deposit and smoothness are primary. It is preferred for such jobs as stop-off in nitriding, and for printed electrical circuits.

M&T Bright Cyanide Copper offers mirror brightness and excellent plating speed as an undercoat for decorative chromium finishes.

Bulletins available on each.

Unichrome is a trademark of Metal & Thermit Corp.

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Metal & Thermit bath uses entirely new addition agents for stability, more dependable operation

Users report that the new M&T Bright Cyanide Copper reduces operating costs and assures uniformly high plating quality with a minimum of control. The low cost solution can be made up with potassium, sodium, or a combination of the two salts.

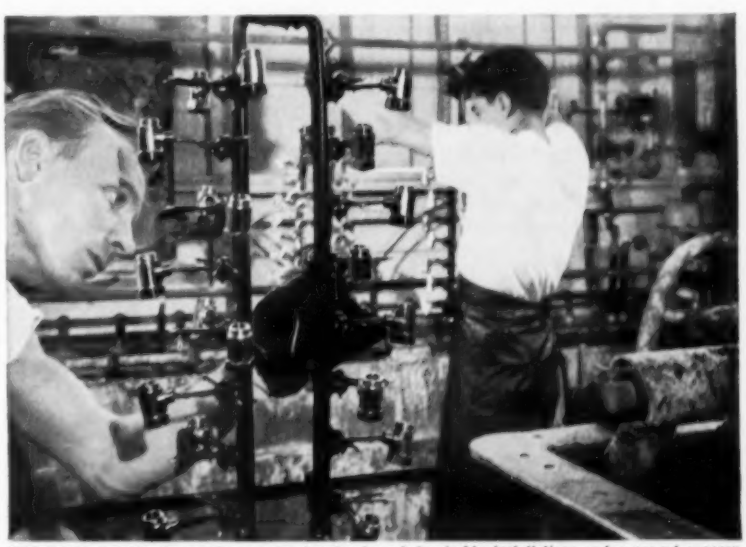
The cost of operation is low due to long life and stability of the addition agents.

The deposits may be mirror-bright, if desired, or of a lesser degree of brightness, depending upon the specific requirements of each installation. The stability of the solution has enabled platers to obtain brighter deposits with greater consistency than ever before.

A wide bright range at high cathode efficiency assures high rates of deposition without burning on edges or dullness in recessed areas. High current densities may be used.

The process provides excellent anode corrosion, utilizing a new bath additive, NEOCHEL, which replaces Rochelle salts. The exceptional stability of this and other additives assures freedom from difficulty due to the accumulation of decomposition products in the bath.

Process control has been simplified. Only one chemical determination and a single Hull Cell test are required for control of the additives.



M&T Bright Cyanide Copper Process is already at work in sizable installations and a proved success.
Photo courtesy Pottstown Plating Works, Inc.

INDUSTRY NEWS

World's largest rack type plating machine, at Ford Motor Co.'s Hardware Division plant, Monroe, Mich. Two such machines, more than 709 feet long, will make this one of the largest plating installations in the world when completed. They will have a ventilation system capacity of more than 700,000 cu ft/min and will plate bumpers for Ford products. The corrosion-resistant and fire-resistant duct work is made of Hetron polyester resin, reinforced with glass fiber. Hetron is made by the Durez Plastics Division of Hooker Electrochemical Co., North Tonawanda, N. Y. The machines themselves, straight line full automatics, are made by the Udylite Corp. of Detroit, Mich.

Diamond Alkali Appoints Canadian Distributor—Diamond Alkali Inter-American Corporation of New York has appointed Nicromatic Limited of Toronto as Canadian distributor of Diamond chromic acid in the electroplating industry.

Gulton to Produce Laminagage—Gulton Industries, Inc., has been awarded a license for the production of a laminagage, under patent rights held by the General Motors Corp.

The laminagage, a production tool used for the checking of platings and coatings on metals and other electrically conductive materials, measures thickness of enamel or ceramic coatings and metal platings to extremely fine tolerances, and can detect pinholes and flaws in production line items not readily seen by inspectors. It operates on the eddy current absorption principle using a sweeping high frequency oscillator.

The licensing agreement between the two companies is non-exclusive.

Foulke Reports on Water at Paris Meeting—Dr. D. Gardner Foulke reported for the entire electroplating industry to the Water and Sewage Waste Division of the International Union of Pure and Applied Chemistry at its meeting, during the last week in July, at the Maison de le Cagmie of the University of Paris.

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Comprehensive manual of 102 pages containing precautions to be observed in collecting samples of metal finishing wastes, fundamentals of sampling techniques, the determination of cyanide, cyanate, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc, ammonia, chloride, chlorine, nitrate-nitrite nitrogen, ortho-phosphate, and sulfate—and a section on pH and residue.

This valuable publication, developed from American Electroplaters' Society Research Project at Lehigh University and expanded and prepared by the Metal Finishing Industry Action Committee of the Ohio River Valley Sanitation Commission is available at

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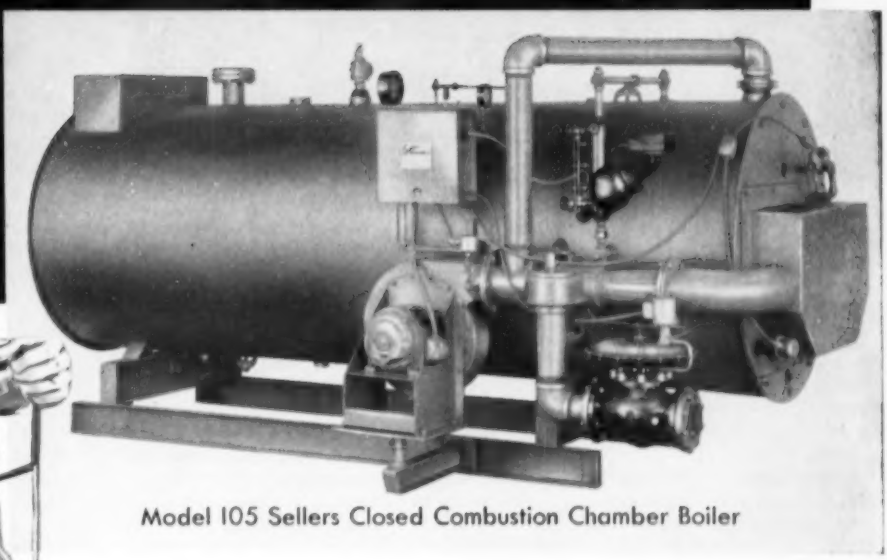

Model 105 Sellers Closed Combustion Chamber Boiler

NOW—No more foul fumes because of incomplete combustion due to back draft through boiler created by exhaust fans or poor draft conditions.

SELLERS solves this problem with the improved design, closed combustion chamber boiler. All air for combustion, both primary and secondary, is pushed through the boiler under positive pressure, independent of partial vacuum in the building and independent of any back draft on the chimney (of course, products of combustion must be removed from building).

A positive pressure blower supplies air under pressure which is mixed with the gas and passed to burners in the completely closed combustion chamber; to complete combustion, secondary air is fed into the closed chamber under positive pressure (many times greater than the vacuum in the building). By this method of securing positive complete combustion, burned gases are pushed through the boiler and FOUL FUMES ARE ELIMINATED.

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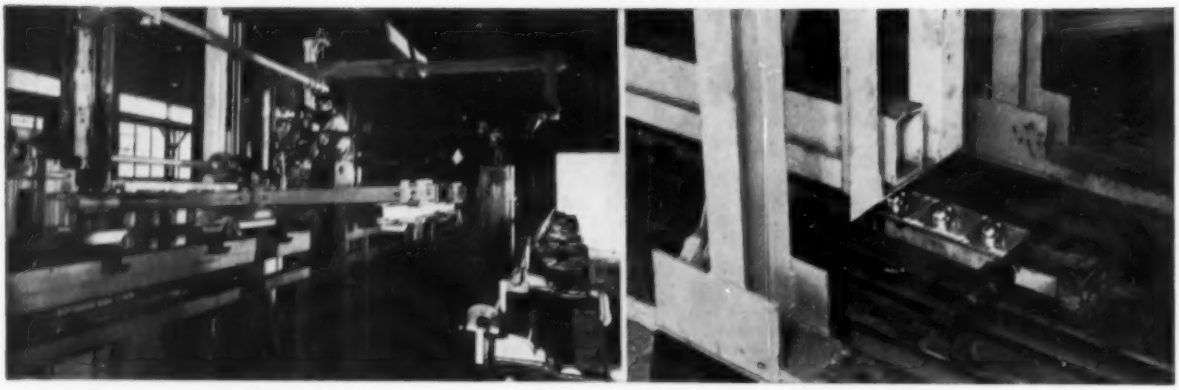


(Left) Some of the features now going into new automatic plating machines. The newly designed friction type clamps may be seen at immediate right. Workers are adjusting rotary actuator which provides "feather" control in movements of the elevator. (Right) Typical of the improvements made via the Wagner mockup is the application of ball rather than roller bearings for carriage movement in equipment being built. Here ball bearing tracks of four different types of special steel are being tested.

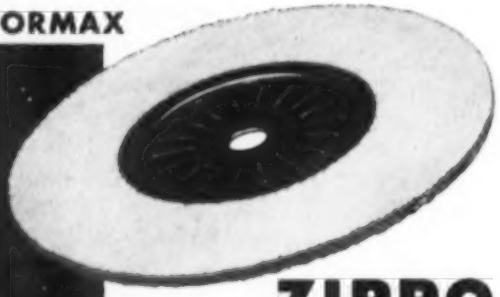
Dr. Foulke's report covered the economic use of water by the electroplating industry throughout the world. The number of industries reporting attested to the general world interest in water conservation.

Dr. Foulke, secretary of Newark Branch, AES, and manager of electrochemical development for Hanson-Van Winkle-Munning Co., flew to France on July 25 and returned by plane August 3.

Graduate Studies for Cowles' Sales Managers—Carl C. Clabaugh, manager of the metal finishing chemicals department and two other sales managers of Cowles Chemical Co., Cleveland, joined in August over 300 hand-picked sales and marketing executives from all over the world to participate in the intensive Executive Development program of the 5th Annual Graduate School of Sales Management and Marketing, sponsored annually on the campus of Rutgers University by National Sales Executives, Inc.—28,000 member world headquarters for marketing management.

Development Mockup at Wagner Bros.—To improve automation in the mechanical end of the plating field, the plating equipment division of Wagner Brothers Inc., Detroit, has combined the drawing board technique with a large scale

FORMAX



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Model 20 New Holland
KREIDER
Centrifugal Dryer

Air-Dries . . .as it Spin-Dries. Kreider Dryer double-action drying speeds production—cuts costs way down . . . gives you smooth moisture-free surfaces—eliminates scarring and marring frequently responsible for costly "rejects."

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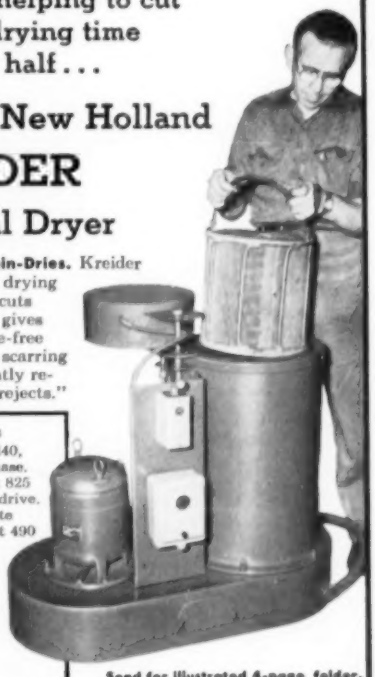

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Here are 6 good methods for making easy jobs out of hard ones

1. For precleaning in the plating shop

Oakite precleaners quickly remove the toughest soils that work their way into the plating shop. This 44-page illustrated booklet gives useful information about tank precleaning on pages 6 to 11 and machine precleaning on pages 11 to 14.

2. For descaling and derusting steel

Oakite Rustripper saves time by removing heat scale and rust in the same operation that removes oil. Alkaline pickling with Rustripper avoids hydrogen embrittlement, etching of machined surfaces and other disadvantages of acid pickling.

3. For electrocleaning steel

Oakite Composition No. 90 is a reverse-current cleaner with great ability to remove oils, smuts and other objectionable films that interfere with good electroplating. Solutions have high conductivity and long service life. Controlled foaming eliminates explosion hazards.

4. For electrocleaning brass

Oakite Composition No. 191 scientifically protects brass from the oxygen that tarnishes during the use of reverse current. Solutions have high conductivity, long life and high tolerance for chromic acid carried over by plating racks.

5. For electroconditioning zinc die castings

Oakite Composition No. 95 anodically removes all films that would impair the brightness of the plate. Under-surface shadows and anodic blackening are eliminated. A manufacturer of die-cast hardware reported "No. 95 cut our cleaning rejects more than 95%."

6. For preventing water spots

Oakite Rinsite causes rinse water to drain rapidly, leaving the plated metal bright, sparkling and completely free from water spots and tarnish. Rinsite is also good as a rust preventive in rinses between barrel finishing operations.

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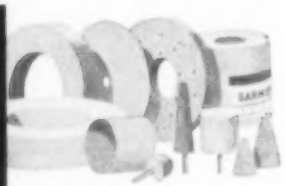

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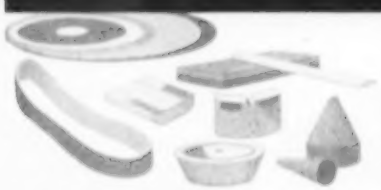

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INDUSTRY NEWS

operating mockup, which makes possible the quick creation of automated, custom-ordered plating equipment, and subsequent fabrication on a semi-mass production basis.

The "shirt sleeve" mockup technique includes:

A design approach that eliminated 65 per cent of the time required to lay out a custom plating machine.

Modular construction which enables the fabrication of custom components from standardized sections.

Some 15 innovations in equipment component design which eliminate many mechanical headaches.

The huge test and development mockup actually is the third built by Wagner engineers to obtain the results required. It represents 1½ modular repetitive sections of an actual automatic plating machine—on an enlarged scale. It also simulates exact operating motions of an actual plating unit, and is employed by company engineers as a proving ground in developing and testing improvements in plating machine structure and operation.

A lofting system enables company engineers to pick off the lofts any plating machine element features desired for a custom ordered machine—to be combined quickly into a master working blueprint for manufacturing. Prior to this method of operation, it used to take about 1300 man-hours of design engineering to build a typical 120-foot plating machine. Under the present system, roughly 350 to 400 engineering man-hours complete the job.

From the modular method of fabrication now used, a giant 45-foot fixture was developed that enables two men to tack and final weld pre-cut steel structural members for the base and uprights of a typical plating machine—in 50 to 60 per cent less time than formerly required.

Another feature of modular construction is the mechanical "splicing" method used to join the various modular sections together. This enables plating machines to be built completely on the production floor, tested and shipped out with a minimum of dismantling.

Of importance to plating equipment users are some of the new concepts of component design, resulting from the day-to-day study of the working mockup. These make possible floor space and chemical savings, and overcome plating operation drawbacks such as work banging together in plating tanks, hangups and bath contamination.

CINCINNATI CONVENTION
MAY 19-22

INDUSTRY NEWS BRIEFS

● A heavy duty machine which can permanently dye aluminum any color is in production on 1958 automobile grills and body trim at the Firestone Steel Products Co. The new anodizing section at Firestone occupies 10,000 square feet of floor space and can treat 5000 square feet of aluminum an hour.

The newly installed anodizing machine contains 21 different sequence solutions. Aluminum to be processed is automatically immersed in each solution the correct length of time. Six different finishes can be turned out simultaneously.

This new anodizing equipment is capable of processing an unlimited number of different finishes, current production is for passenger car grills and panel trim in color for popular models in high production. Firestone has manufactured grills of steel with chrome plating since 1951.

● A 12-week electroplating course of study at Mumford High School, Detroit, Mich. started on the evening of September 17, 1957. This course is a basic science course to furnish information relating to electrochemistry and plating. This course will provide the necessary scientific background to better understand the reactions and information available on plating processes. It is not designed to solve plant problems but to provide information to assist people in solving their own problems. The course is being offered at the request of the Detroit Branch of the American Electroplaters' Society.

● Consistent with the policy of seasoned business executives to teach professional business subjects, G. S. Corigliano, manager of advertising and sales-promotion, Sel-Rex Corporation, Nutley, N. J., has been appointed co-adjutant staff lecturer in advertising, Rutgers University, Evening Extension, Paterson, N. J. branch. According to information from the offices of the chairman of the Department of Marketing, Corigliano has been scheduled tentatively to teach courses in Advertising and Industrial Marketing during the coming fall and spring semesters.

Mr. Corigliano is a member, and on the speakers list, of the Direct Mail Advertising Association, and on the board of directors of the National Industrial Advertisers Association, N. J. Chapter, where he is also chairman of the Special Projects Committee. In this latter capacity, it is reported, Mr. Corigliano plans to announce shortly the availability of experts in various phases of Advertising and Industrial Marketing, as guest speakers to address business organizations and university-level advertising classes.

● For the first time in its 103-year history the Polytechnic Institute of Brooklyn is located in new quarters this fall.

As classes began on September 23, more than three-fourths of the Institute's 5900 graduate and undergraduate students moved five blocks north to a new home instead of to the century-old red brick buildings on Livingston Street.

The move represents the first major step in relocating one of the nation's largest schools of science and engineering which has "grown into" 15 scattered locations in the Borough Hall area of Brooklyn.

In 1953, Polytechnic purchased the block square industrial plant of the American Safety Razor Company for $2,000,000. Bounded by Jay, Johnson, and Lawrence Streets and Myrtle Avenue and facing Brooklyn's new $125,000,000 Civic Center, the site was deemed ideal for a school of science and engineering.

● Acoustica Associates, Inc., designers and manufacturers of ultrasonic cleaning units, liquid level sensors; entire cleaning systems for industry; have moved from Glenwood Landing to new and larger quarters at 26 Windsor Avenue, Mineola, L. I.

● Mine production of copper at domestic mines in June was 2 per cent less than in May, but on a daily average basis exceeded the latter month. Output for January-June 1957 was 3 per cent less than in the corresponding period of 1956.

Color Control of Brass Plating

●

It is entirely possible to control the color of brass plating. It requires maintenance of solution composition, temperature and other pertinent factors such as amount of agitation. Current density should not be a major factor as the same color can be maintained over a wide range by the proper solution composition.

●

Yellow brass is the simplest to maintain of all while the darker shades require more attention. The exact solution compositions for a given color can be varied over a fairly wide range with proper compensation in other factors. There are still some definite rules to follow and we've never seen these rules properly laid out except in our own literature. Of course many people don't agree with us who have their own axes to grind but the successful platers are following them even when they operate on a different theory, which happens to give them a composition that falls within the proper ranges.

●

To maintain color you can of course add the basic chemicals after a daily or twice daily analysis. If you want the easy way you can just make the daily additions of True Brite Brass Maintenance Solutions or Compounds. These are balanced blends which give you the same uniform results. No accurate weighing is necessary as we carefully check each batch to insure uniformity and all materials are in balance so that any reasonable underdose or overdose still leaves the solution in balance. Most of our customers with good laboratories analyze even the bronze shades once a week and yellow brass solutions even less often.

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Excerpts from the Naval Research Laboratory Report: EFFECT OF BAKING ON DELAYED FRACTURE OF ELECTROPLATED ULTRA HIGH-STRENGTH STEEL. ***By B. F. Brown, Physical Metallurgy Branch, Metallurgy Division, Department of the Navy, Office of Naval Research.***

Experience with cadmium-plated high-strength steels has shown that fracture may occur in service after a period of time under an essentially constant stress much lower than the yield strength. This phenomenon, described variously as "delayed fracture," "static fatigue," or "room-temperature stress-rupture," is known to be associated with the presence of hydrogen in the steel. This hydrogen may be introduced by reaction with water vapor or other hydrogen-bearing gas while in the molten state or while heated during processing, or by reaction when cold with water or with acid. Hydrogen can also be introduced into steel by making it a cathode in an aqueous electrolytic cell, in which current from an external source is passed in such direction that hydrogen is discharged (is "plated out") at the surface of the steel. Some of this hydrogen may pass off as bubbles, but some will dissolve into the steel. This process is termed "cathodic charging," and it leads to the same delayed-fracture behavior which is observed in steel with unduly high hydrogen derived from melting or processing.

When high-strength steel, relatively low in hydrogen and hence not susceptible to delayed fracture, is cleaned and electroplated with cadmium (or with certain other metals) by the standard commercial processes, it becomes highly susceptible. Since the phenomenon of delayed fracture has otherwise been attributed only to hydrogen in the steel, and since there is opportunity for hydrogen to be introduced both during the acid dip (customarily practiced preparatory to plating) and during the actual plating operation (when both cadmium and hydrogen are being discharged at the cathode), it is presumed that hydrogen is an essential factor in the delayed fracture of plated steel in service. The hydrogen introduced during plating is much less than *can* be introduced by cathodic charging, and the possibility exists that it will be sealed in by the electroplate, unlike the case of cathodic charging. Also the hydrogen introduced during plating is not likely to be distributed throughout the specimen in quite the same manner as that derived from steelmaking. For these reasons the effect of hydrogen introduced by electroplating will be termed here "plating embrittlement" as a somewhat special case of "hydrogen embrittlement," the term "embrittlement" being used whether the effects of hydrogen are manifest in tests of susceptibility to delayed fracture or in other types of tests.

AISI 4340 steel is used extensively in the aircraft industry for such diverse articles as bolts, tubing, and heavy forgings—all of which may be plated with cadmium for corrosion resistance and some of which may be plated with chromium for wear resistance. Because of the very widespread interest in the 4340 steel, and because of the history of delayed fractures in service of plated 4340 articles, this steel was selected for the present investigation.

There does not appear to be a sharply defined strength level above which cadmium plating causes delayed fracture and below which it does not, but rather the general experience points to a continuously rising susceptibility with rising strength level—perceptible plating embrittlement at the 180,000 psi ultimate strength level and acute embrittlement at the 290,000 psi level. Since a satisfactory solution to the embrittlement problem must be effective for the higher strength steels, and since such a solution would automatically take care of the lower strength steels, the present investigation was concentrated largely on two levels of approximately 285,000 psi and 225,000 psi with a few experiments on steel of 180,000 psi ultimate tensile strength.

Previous work on this problem had shown that vacuum-melted 4340 steel and air-melted 4340 steel, both low in initial hydrogen, were highly susceptible to failure by delayed fracture after they had been cadmium plated.[1] Any progress must therefore lie either in keeping out the hydrogen introduced preparatory to and during plating or, if entry is not prevented, in some sort of treatment which would mitigate the hydrogen embrittlement either by driving out the hydrogen or by redistributing it so that it is nowhere concentrated to a dangerous level.

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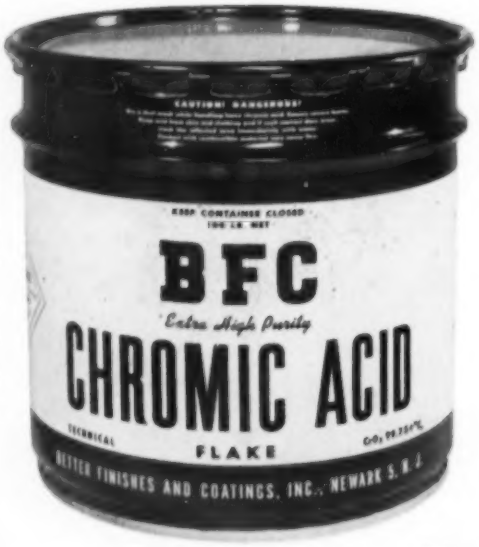

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Studies of delayed fracture in unalloyed high-carbon steel under torsion loading have indicated that baking at 400 F following cadmium-plating effectively eliminated delayed fracture;[2] and constant-rate bend tests on chromium-plated and on cadmium-plated stainless steel (type 440-C) suggested that recovery of this material by baking was rapid even as low as 212 F.[3]

The purpose of the present investigation was to assess the effectiveness of similar baking treatments on the susceptibility of plated high-strength steel to failure by delayed fracture, using some test suitably related to pertinent service conditions. Since the object of this phase is thus to study the removal or mitigation of embrittlement rather than its prevention, both the acid-dip preparatory treatment and the cadmium cyanide plating bath were used; in the plating industry they are widely employed and highly effective in producing an adherent and smooth coat.

Experimental Procedure

Except as otherwise described, specimens from the machine shop were vapor-degreased in trichlorethylene, further cleaned anodically in a commercial warm alkaline solution,* rinsed, etched 4 minutes in 50 per cent HCl (technical grade) at room temperature, rinsed, and plated immediately. The plating details were essentially those followed by commercial jobbing shops.** The plate thickness measured on the barrel was 0.0005 in. for cadmium and chromium plates. Zinc was plated to two thicknesses, 0.0007 in. and 0.0020 in.

Unless otherwise noted baking was conducted in a forced-circulation silicone oil bath.***

Summary and Conclusions

1. The delayed-fracture notched-tensile test has been applied to study the effectiveness of baking treatments to relieve the susceptibility of electroplated high-strength 4340 steel to delayed fracture. The steel was studied as heat-treated to the following strength levels: 285,000 psi, 225,000 psi, and 180,00 psi. Cadmium, zinc, and chromium were deposited according to commercial practice.

2. Baking at 350 F for 24 hours essentially completely removes the susceptibility to delayed fracture of chromium-plated steel.

---

*Hanson-Van Winkle-Munning Co. "Matewen 30 W" at 180 F.

**Cadmium: 3½ oz CdO and 17 oz NaCN per gal, and 12 oz per 100 gal of R. O. Hull Co. "ROHCO-20XL" brightener. Bath temperature approx. 75 F, c.d., 25 amp/sq ft. Zinc: 8 oz ZnO, 5.6 oz NaCN per gal. Bath temperature 75 F, c.d., 25 amp/sq ft. Chromium: Standard commercial ("Unichrom 110") acid bath, 120 F, air-agitated, c.d., 280 amp/sq ft.

***On the chance that reducing the atmospheric pressure might enable hydrogen to break through the cadmium film, three pairs of specimens were baked, one of each pair in oil and one in vacuum, and the specimens loaded at three stress levels. The breaking times for the specimens baked in vacuum did not differ significantly from those baked in silicone oil.

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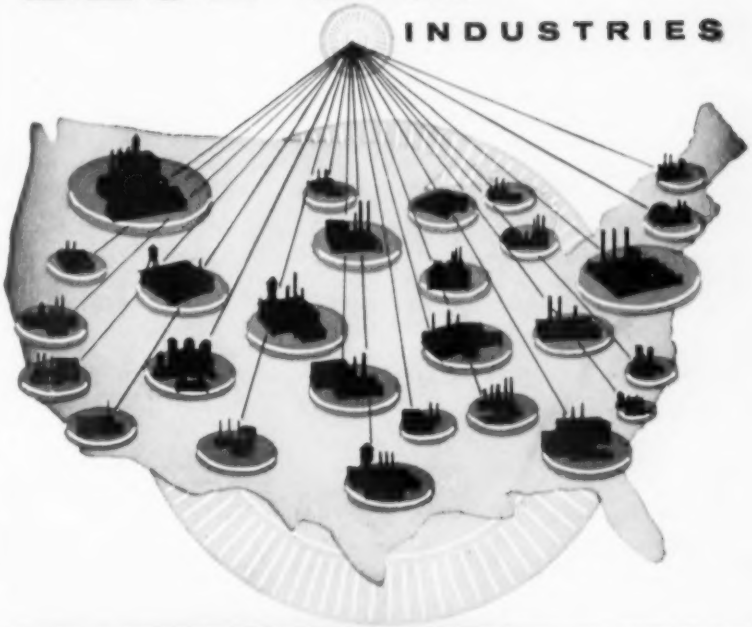

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3. Baking at 350 F is only partially effective in removing the susceptibility to delayed fracture of cadmium-plated steel. The higher the strength level of the steel, the less effective is the treatment.

4. Baking at 350 F is essentially ineffective in removing susceptibility to delayed fracture of zinc-plated steel.

5. Increasing the baking temperature (within the limits imposed either by the tempering temperature of the steel or by the volatility or reactivity of the cadmium) may or may not be effective above about 350 F.

6. The fact that zinc, chromium-, and cadmium-plated specimens behaved differently in baking indicates clearly that any improvement from baking represents loss of hydrogen through the plate (or perhaps *to* the plate) rather than redistribution of hydrogen within the body of the steel.

7. To be adequately sensitive, a test for hydrogen embrittlement must be a static (delayed-fracture) test on material of representative ductility and with provision for suitable stress concentration. Earlier reported successes with baking of cadmium-plated, high-strength (low-ductility) steel are attributed to use of dynamic test methods or to use of low stress concentrations.

8. Since, regardless of initial steel quality (i.e., even with low hydrogen vacuum-cast heats) and regardless of baking treatment, substantial susceptibility to delayed fracture remains in very high strength 4340 steel cadmium-plated from the cyanide bath, the ultimate solution is to employ an electroplating bath which either does not discharge much hydrogen or alternatively gives a plate sufficiently porosity to permit exit of hydrogen. Studies on such cadmium baths are under way and will form the subject of a future report.

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Industrial Water and Industrial Waste Water. ASTM Special Technical Publication No. 207, 52 pages. AES members $1.80. Nonmembers $2.00.

Water has become one of the nation's most important engineering materials because of the rapid rise in demand. Utilities, chemical processors, the petroleum industry and, in fact, almost every major industry requires large quantities of water for power, steam and processing. At the same time the demand for purity and control of corrosion have made the task of supplying industrial water doubly difficult.

The disposal of industrial water has of late become increasingly important. Stream pollution and reuse of water by other industries has made control of waste products a major concern of water chemists and engineers.

This symposium covers several aspects of the problem. It was presented at the Second Pacific Area National Meeting, Los Angeles, under the auspices of the American Society for Testing Materials Committee D-19 on Industrial Water. Among the papers presented are: "Three is a Vital Number," by C. K. Rice, coordinator, Refinery Technology Laboratory, Gulf Oil Corp., Philadelphia, Pa.—an introduction discussing the roles of the public, industry and governmental regulatory agencies. "Committee D-19: The First Quarter Century," by Robert C. Adams, Superintendent, Chemical Engineering Laboratory, U. S. Naval Engineering Experiment Station, Annapolis, Md. A brief history of the committee's activities and a look toward its future work. "Industrial Waste Problems in Southern California," by T. C. Wilson, materials testing engineer, Bureau of Standards, City of Los Angeles, Calif. "Water Pollution Control in the Los Angeles Area," by Carl B. Johnston, engineer, Pomeroy and Associates, consulting engineers, Pasadena, Calif. "Sea Water Purification," by O. M. Elliott, Sun Oil Co., Philadelphia, Pa.—Distillation, which has been used successfully for years, and problems related to it as well as several other methods under study and in various stages of development are discussed. "The Use of Organic Flocculants and Flocculating Aids in the Treatment of Industrial Water and Industrial Waste Water," by J. K. Rice, vice president, Cyrus Wm. Rice & Co., Industrial Water Consultants, Pittsburgh, Pa.

This book is of interest to chemists, and all those concerned with the source, processing, use and disposal of industrial water.

Solvent Extraction in Analytical Chemistry by George H. Morrison and Henry Freiser. 269 pages. AES members $5.75. Nonmembers $6.75.

The first part of this new book, devoted to principles, presents a systematic classification of extractions. The authors develop a generalized theory to show the similarity between the many metal extractions reported in the literature, and deal in detail with such aspects as formation of metal complexes, distribution of extractable species, and chemical interactions in the organic phase. This section also discusses the quantitative equilibria and kinetic factors in extraction, rounding out the theoretical aspects of solvent extraction from the chemist's point of view.

The second part of the volume, based on the authors' own experience, is concerned with the practical aspects of the subject, including apparatus and general techniques. The third section contains a survey of the many individual extractions, arranged in a logical and useful pattern. The treatment here affords an overall picture of the possible separations and the extent of interferences encountered in particular systems. In the final section, the authors cover selected procedures for the extraction of the elements, keeping in mind the chemist confronted with practical problems of separation.

Dr. Morrison is in the Research Laboratories of Sylvania Electric Products, Inc. in Flushing, New York, where he is head of analytical chemistry. Dr. Freiser is associate professor of chemistry at the University of Pittsburgh.

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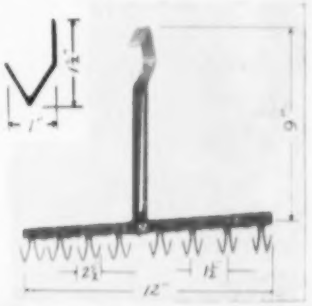

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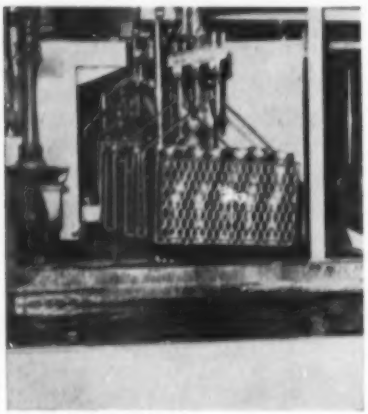


E—1000. Automatic Indexing—A dip process machine which indexes automatically for multiple-stage finishing operations has been developed by Cincinnati Cleaning and Finishing Machinery Co. This indexing machine, a departure from conventional methods, permits the use of shorter dip tanks; it dips baskets of parts in a series of tanks as baskets travel suspended from a single, closed-loop monorail conveyor. The operation is entirely automatic, from the first dip through conveyor unloading.

The space-saving tanks are only long enough to permit entry and processing of parts, thus eliminating the long, space-consuming dips and rises characteristic of monorail conveyor systems. As the conveyor indexes in transit, the baskets of parts are automatically submerged for processing; when the conveyor again indexes, the baskets are raised and positioned for the next cycle.

This new unit is adaptable to any dip finishing requirements. The use of stainless steel, lead and rubber tanks makes it practicable for pickling processes.

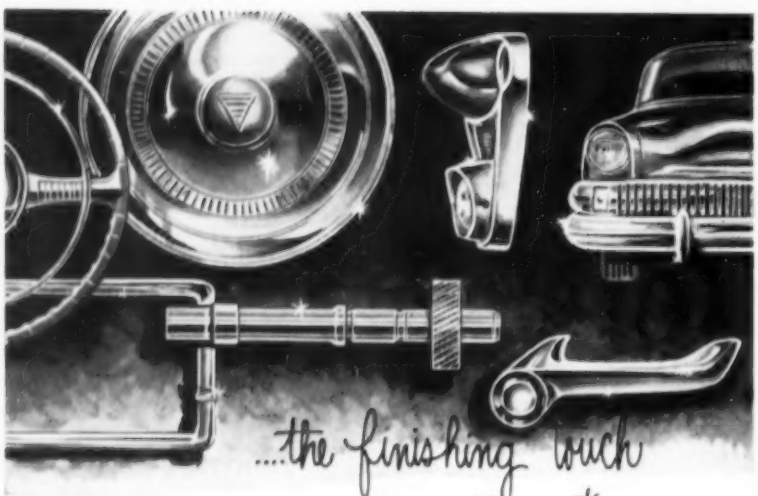
E—1001. Preparation Processes—Enthone, Inc., a subsidiary of American Smelting & Refining Co., has announced the first two of a series of new preparation processes for electroplating. These processes offer a complete cycle for cleaning and preparing various metals to give maximum adhesion with various plated coatings.

The Enbond "Z" process, for the treatment of zinc base diecastings, utilizes a formulated and balanced anodic electrocleaner and a companion acidic activator to produce a uniformly active surface ready for standard copper plating operation.

The cleaner and activator are both supplied as powders, eliminating the constant handling of liquid acids. The activator has been designed for long life to eliminate the frequent necessity of draining and refilling the dilute acid tank. Both the cleaner and the activator are so formulated as to be useful over a wide range of concentration, temperature and time.

The second process, called the Enbond "BR" process, is similar in nature to the "Z" process, but is intended for preparation of brass and other copper alloys for any type of electrodeposit. Both the cleaner and the activator are powdered products and their formulation is such that they can be used satisfactorily for preparation of many steels also. Precleaning may be required when both copper and iron alloys are treated in the same baths.

E—1002. Orange-Lined Tumbling Barrels—Visibility, ease of cleaning and long wearing qualities are improved with these orange-colored vinyl plastic lined tumbling barrels. The resilient linings feature a "No-Seam" application and provide a smooth, light-reflecting surface for cleaning and inspection. Available on all Rampe tumbling barrels for new equipment or replacement, the orange linings replace earlier black plastic linings. They are highly resistant to wear and abrasion, oils and most chemicals. Made by Rampe Manufacturing Company, 14915 Woodworth Avenue, Cleveland 10, Ohio.



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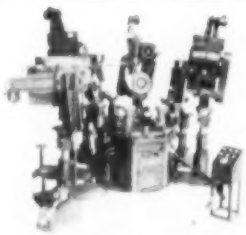

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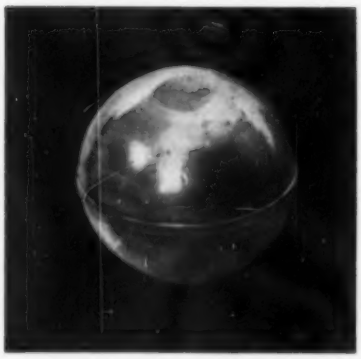

E—1003. Forged Copper Ball Anode—The "Spher-O-Forged," a new forged copper ball anode just put on the market by Chase Brass & Copper Co., is cold forged pure electrolytic copper. Because of its uniformly dense structure, and because flat areas have been reduced to a minimum, the Spher-O-Forged anode, which is 2 in. in diameter and weighs approximately 1.5 lb per ball, weighs 10 to 20 per cent more than most copper ball anodes and is said to last longer in the plating bath. These anodes have a smooth, clean, bright surface and are free of the pits and inclusions found in cast ball anodes. They have increased throwing power, disintegrate uniformly with an adequate skin, leave no undissolved copper, and minimize scrap loss due to sludge. The manufacturer offers a free sample to firms.

E—1004. Restores Contaminated Plating Baths to Production—The restoration of contaminated cyanide electroplating baths to full trouble-free production is now possible through the use of Pur-A-Salts, reports the Precious Metals Division, Sel-Rex Corp. This latest Sel-Rex development consists of a patented formulation of barium double metal cyanides such as barium gold cyanide, barium silver cyanide, barium copper cyanide, or barium in combination with other cyanide electrolytes.

According to Sel-Rex's patent, Pur-A-Salts removes carbonates, sulfates, and chromates through preferential precipitation depending on their solubility. The precipitation is effected on a molar basis—three ounces of silver Pur-A-Salts will remove one ounce of sulfate or carbonates, and will supply about 1.35 oz of metallic silver. Not only is the free cyanide content of the bath undisturbed, but impurities are removed while other bath constituents are maintained at the desired ratios.

E—1005. Ultrasonic Cleaning Generator—Branson Ultrasonic Corp. has introduced a new size generator in its line of ultrasonic cleaning devices. The Sonogen model AP-25-B was designed for use with standard Branson tank-type or all-welded stainless steel immersible transducers. It is recommended for unattended and quick cleaning of small parts. For cleaning-rinsing or other two-step operations, the generator output can be switched easily between transducers mounted in separate tanks.

Because the tank is of stainless steel, organic solvents, detergents, alkaline solutions, and some acids may be used without harming the transducer.

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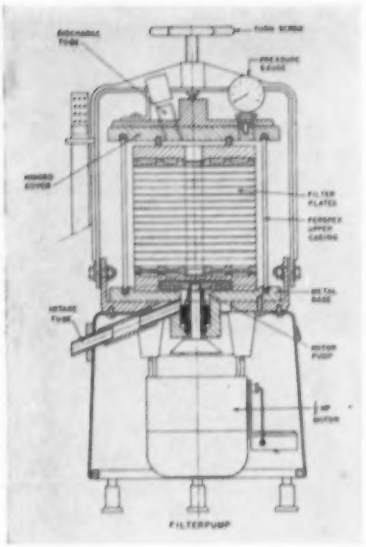

E—1006. Portable Filter—Compact design of a new plating solution filter combined with an increased capacity of up to 900 gph free flow (or about 600 gph with carbon charge), has been announced by Hanson-Van Winkle-Munning Co. Although it measures only 15 by 15 by 28 in., the portable filter has 3.5 sq ft of filter area provided by 16 Perspex plastic plates.

New filtering design features a solution entrance at the bottom of the unit and discharge at the top in order to effectively prevent the liquid from by-passing the filter. The special transparent casing of tough, stable thermo-plastic permits thorough visual inspection of filtering action.

The H-VW-M Dincalux portable filter is for use in plating rooms as a general purpose unit. It may be used for intermittent or constant filtering or transfer pumping. The filtering section is mounted on rubber gaskets between upper and lower housing plates. A brass pressure gauge is mounted atop the filter housing to indicate when the efficiency of the filter is reduced to a point requiring cleaning. Overall unit design permits ready disassembly for cleaning to save maintenance downtime.

E—1007. Ultrasonic Processing Tanks—The General Ultrasonics Co. has introduced new 5- and 8-gal Sonitanks designed for economical ultrasonic processing.

Important features include ultrasonic efficiency operating at a resonant frequency of 20 KCS/sec. A new method of attaching the reinforced transducer elements by riveting results in extreme ruggedness and greatly increased efficiency in the conversion of ultrasonic energy.

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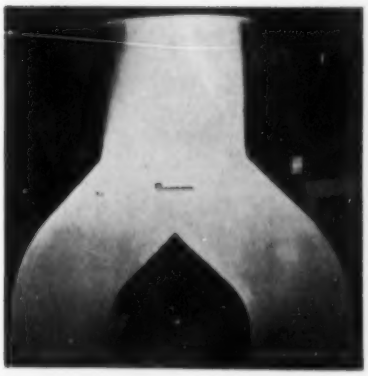


E—1008. Corrosive Fume Duct Material—A new two-ply type light-weight plastic construction material for severe corrosive fume service has been developed and introduced by Heil Process Equipment Corp. Rigiply is a fiber glass reinforced laminate of thermosetting resins resistant to a much wider range of chemicals, both acids and alkalies, than has been possible in the past. It can be engineered and fabricated for use in fume exhaust hoods, ducts, stacks, fume scrubbers, and tank covers for pickling, plating, and chemical plant operations up to temperatures of 250 F.

E—1009. Acid Inhibitor—Enthone, Inc., subsidiary of American Smelting and Refining Co., has announced the development of Acid Inhibitor 11 for use in acid solutions. This new inhibitor can be used on high carbon steel without the dangers of etching. It is used at a very low concentration of about 0.2 per cent by volume and can be added to cold or hot sulfuric or muriatic acids, or to other non-oxidizing acids such as phosphoric, hydrofluoric, oxalic and citric acids. It has no odor and does not produce a foam on the acid solution.

E—1010. Solvent Vapor Degreaser—Development of a low cost solvent vapor degreaser is announced by Tect, Inc. of Dumont, N. J.

Eliminating the fire hazard of gasoline, naphtha, and mineral spirits, model 10 solvent vapor degreaser is constructed of 14 gauge steel with a heavy zinc coating.

A stainless steel coil maintains the vapors of the chlorinated solvent at the proper level. A work rest and a light-weight, galvanized steel basket are also provided. The bottom is insulated with asbestos and fiberglass.

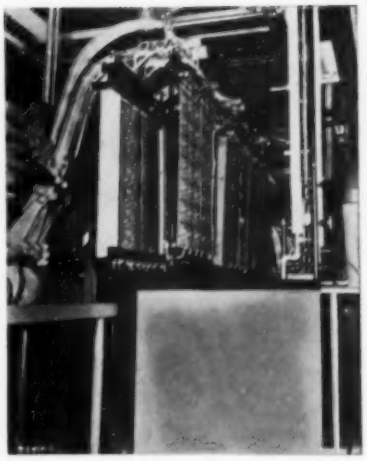
The unit includes inlet and outlet hoses for quick connection of the condenser to tap water supply. It will clean a minimum of 100 lb of steel per hour in the clean vapors of non-flammable solvents, such as perchloroethylene or trichloroethylene.

E—1011. Steam Cleaner—Kelite Corp. has introduced a new three-model series of direct-fired steam cleaners.

The Mark I, designed for light to medium duty, has an output of 120 gallons per hour. The Mark II, for medium to heavy duty, has a 200 gph output. The Mark III, with an output of 300 gph, is designed for maximum duty. The output of all three Kelite Steam Cleaners is rated at 320 F.

Each of the new steam cleaners provides a positive displacement piston pump capable of delivering its full rated output hundreds of feet from the machine; an efficient water-wall heat exchanger to provide maximum fuel economy; and a gas or oil burner which provides instant starting.

Standard equipment includes one heavy-duty steam cleaning gun with swivel-type rear grip and a forward grip aerated to provide cool operation; a Hy-Vel (high velocity) spray nozzle; and heavy duty hose.



E—1012. Printed Circuit Production Line—An automatic production line for plating printed circuits incorporating a Stevens Automatic Processing Machine, was recently engineered by Frederic B. Stevens, Inc.

The machine is designed for copper plating circuits and is capable of producing over five million individual circuit boards annually.

The plating tank is 75 feet long. Each individual arm holds two racks, each rack holding 24 plastic boards in position for the electrolytic deposition of the copper wire patterns.

E—1013. Nylon Work Pants—Cotton work clothes are said to wear an average of 70 per cent longer when made of a fabric fortified with a new type of nylon just introduced by the Du Pont Co.

Work pants containing this new fortifying fiber, Du Pont 420 nylon, will be available this fall. They will cost about 25 per cent more than comparable all-cotton work trousers.

The new nylon, result of four years of research, development and testing in actual wear, is described as a fiber that is engineered to be a "good working partner" with cotton.

E—1014. Rack Parts—Standard components for plating, anodizing and painting are contained in the Erect-A-Rack announced by the Standard Plating Rack Co. The preformed parts can be assembled with only a wrench and are reported to save 60 to 90 per cent in labor by eliminating drilling, tapping and bulky equipment. Nearly all possible combinations of rack contacts and arrangements are possible by merely clamping the desired contacts on a spine, sliding along to obtain the proper spacing, then tightening.

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PREVIEW OF FUTURE PLATING ISSUES

•

NOVEMBER 1957

AIRCRAFT. Electroplating and metal finishing in the aviation industry will be featured in this issue.

•

JANUARY 1958

ABRASIVES AND MECHANICAL FINISHING. Third annual issue of this popular yearly feature.

•

MARCH 1958

ORGANIC COATING. Like last year's edition, this issue will feature organic finishing.

•

APRIL 1958

TECHNICAL RESEARCH. Not only will this issue spotlight recent developments in the AES Research Program but will also be the pre-1958 ANNUAL CONVENTION feature issue.

•

MAY 1958

CONVENTION ISSUE. Inasmuch as the 1958 Annual Convention will be held in Cincinnati, Ohio, May 19–22, this feature issue will come in May instead of June as customary.

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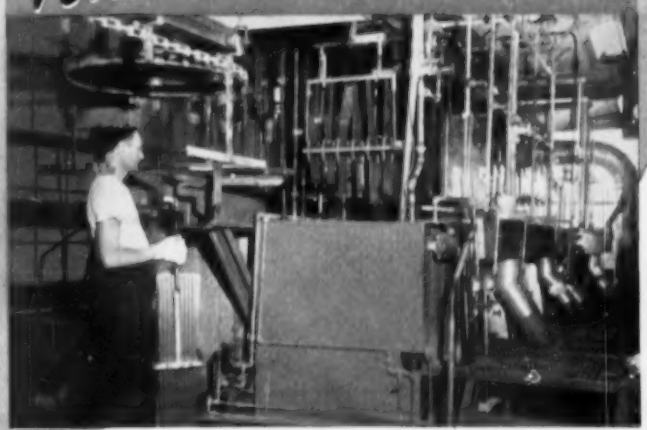

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L—1015. Germanium Power Rectifier Junctions—International Rectifier Corp. has issued Bulletin GPR-2 containing 12 pages of general germanium rectifier application data. The bulletin includes a table of circuit diagrams, transformer connections and rectifier ratings and a page of information about how to use the table. several types of germanium rectifiers are described and illustrated.

L—1016. Sealless Pumps—A new and comprehensive eight-page catalog describing the Vanton Flex-i-liner sealless plastic and stainless steel pumps and containing technical data and material selection information has just been released by Vanton Pump & Equipment Corp.

These pumps are regarded by Vanton as unique in the processing field, since they have no stuffing boxes, glands or shaft seals through which damaging leakage or contamination can occur, and their features are clearly set forth in the catalog No. 10.0 which is being made generally available.

The catalog includes an explicit description of the pump work, performance data with pump characteristic curves and charts with sizes, capacities, operating pressure ranges, and other performance data.

L—1017. Magnetic Motor Starters—A 20-page publication contains comprehensive data on General Electric's radically new Nema Size 0 and 1 magnetic motor starters for such applications as machine tools, pumps, hoists, blowers, fans, mixers, and motor control center.

Illustrated bulletin shows how product's design contributes to fast installation, simplified wiring, easy inspection and maintenance.

L—1018. Filtration Systems—The Industrial Filtration Division of the United States Hoffman Machinery Corp. has announced the publication of a new four page, two-color brochure FB-100 describing the parts, principles and application of Hoffman centralized filtration systems.

L—1019. Welding of Stainless Steels—A new 20-page booklet "A Guide to Better Welding of Stainless Steels" has been issued by the Arcos Corp. Intended for both the experienced and less experienced welder, the guide answers many of the questions that arise in how to get best results. The entire presentation is made in question and answer form. The booklet is freely illustrated with drawings and closeup photographs to clarify both the problems and solutions.

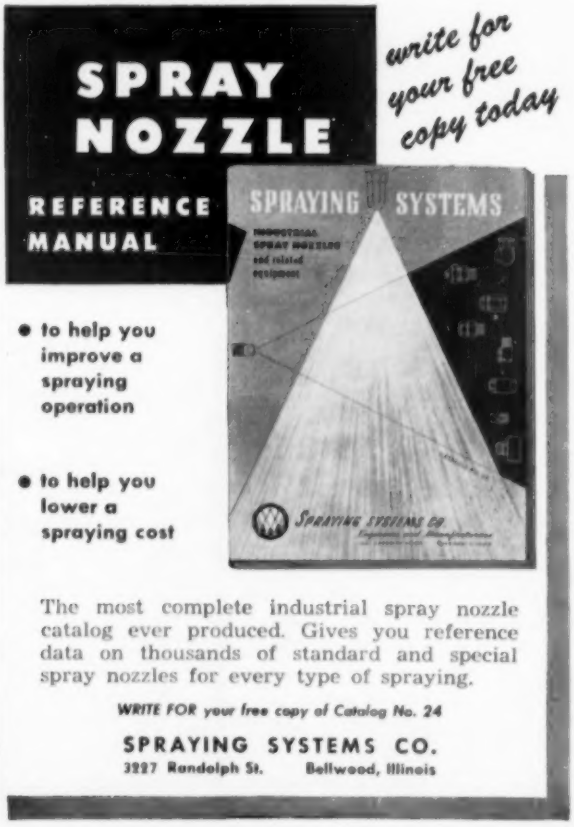
L—1020. New Burnishing Compound—Oakite FM 103, the latest addition to the company's family of barrel finishing materials, is the subject of a service report just published by Oakite Products, Inc.

Specially compounded to improve brightness of work, Oakite FM 103 is said to develop exceptional color and luster on brass, copper, nickel-silver, gold, and mild and hardened steel parts.

The report discusses the new material's economy in use, its effectiveness in lubricating the work, and its safety on steel media. Application details are described.

E—1021. Rack and Plating Machines—Electroplating—anodizing and other treatments of aluminum—dichromate, stripping, cleaning, pickling, bright dipping, phosphating and similar immersion processes can all be performed on Stevens automatic rack processing and plating machines featured in a recent Stevens bulletin No. 61.

More than a dozen different working installations are illustrated as well as a series of photographic views that detail machine construction and operation.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ARTICLE REFERENCES

By
WILLIAM TUCKER
Eastman Kodak
Rochester, N.Y.

Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

309. CORROSION

a. *ROLE OF CORROSION INHIBITORS IN WATER TREATMENT.*
E. L. Streatfield.
Corrosion Technology, *4*, No. 7, July 1957, p. 239–244.

310. COST CONTROL

a. *A TENTATIVE APPROACH TO COST CONTROL IN ELECTROPLATING.*
J. M. Alameda.
Electroplating and Metal Finishing, *10*, No. 7, July 1957, p. 213–215.

311. DESIGN

a. *HOW DESIGN AFFECTS COST OF CHROME-PLATED DIE-CASTINGS.*
Dan H. Robinson.
Product Engineering, *28*, No. 5, May 1957, p. 190–193.

312. EDUCATIONAL

a. *ELECTROCHEMISTRY AND THE PLATER.*
Fred G. Brune.
Products Finishing, *21*, No. 11, August 1957, p. 44–48.

313. EQUIPMENT

a. *NACE TECHNICAL COMMITTEE REPORT. NACE TECHNICAL UNIT COMMITTEE T-1J ON OIL FIELD STRUCTURAL PLASTICS.*
Ward B. Sanford, Chairman.
Corrosion, *13*, No. 7, July 1957, p. 55–56.

314. FINISHING

a. *BARREL FINISHING.*
Arthur S. Kohler.
Metal Finishing, *55*, No. 8, August 1957, p. 58–64.

315. HYDROGEN

a. *NACE TECHNICAL COMMITTEE REPORT.*
Arnold E. Schuetz and W. D. Robertson.
Corrosion, *13*, No. 7, July 1957, p. 33–34.

316. NICKEL

a. *NICKEL OUTLOOK GOOD; SIGNS POINT TO END OF FAMINE.*
F. J. Starin.
The Iron Age, *180*, No. 7, August 15, 1957, p. 51–53.

b. *BRIGHT NICKEL PLATING ON CAST IRON.*
E. Alary.
Electroplating and Metal Finishing, *10*, No. 7, July 1957, p. 227.

317. ORGANICS

a. *EXPERIMENTS MADE TO DEVELOP AN ORGANIC LACQUER RESISTANT TO WHITE FUMING NITRIC ACID.*
George W. Grupp.
Organic Finishing, *18*, No. 7, July 1957, p. 12.

318. ORGANICS—APPLICATION

a. *ELECTROSTATIC APPLICATION.*
E. S. Beck.
Organic Finishing, *18*, No. 7, July 1957, p. 8–11.

319. ORGANIC COATINGS

a. *A SURVEY OF PAINT APPLICATION METHODS.*
Ezra A. Blount.
Products Finishing, *21*, No. 11, August 1957, p. 24–35.

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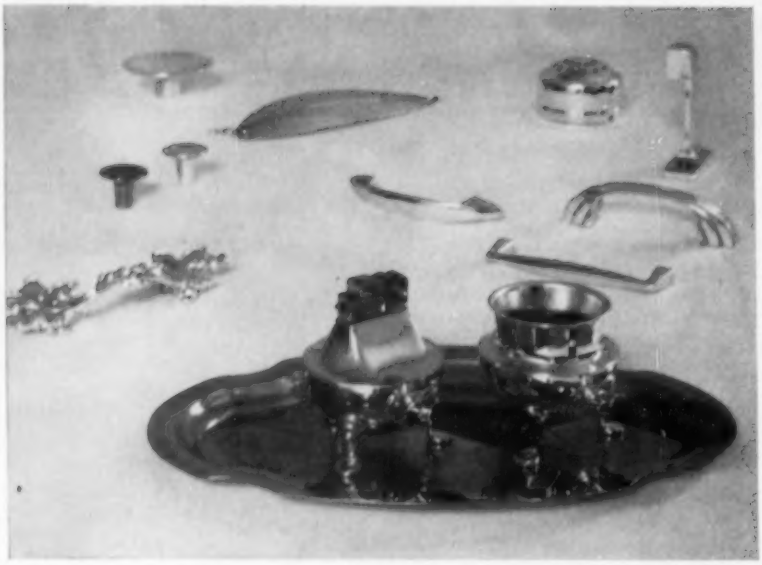

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320. ORGANICS—EQUIPMENT

a. *FACTORS TO CONSIDER IN SELECTING AUTOMATIC SPRAY EQUIPMENT.*
Eric H. Cocks.
Organic Finishing, *18*, No. 7, July 1957, p. 13.

321. PLANT LAYOUT

a. *PLATING AND SURFACE FINISHING FACILITIES FOR A MACHINE SHOP.*
C. C. Clayton.
Products Finishing, *21*, No. 11, August 1957, p. 36–41.

b. *NEW PLATING AND POLISHING DEPARTMENT AT RANK PRECISION INDUSTRIES, MITCHELDEAN.*
Metallisation Ltd.
Electroplating and Metal Finishing, *10*, No. 7, July 1957, p. 216–220.

c. *PLATING PLANT LAYOUT. PRIZE WINNING ENTRIES IN THE INSTITUTE OF METAL FINISHING COMPETITION.*
Electroplating and Metal Finishing, *10*, No. 7, July 1957, p. 223–225.

322. PREPARATION

a. *FOR COATINGS THAT LAST, GET BASE METALS CLEAN.*
S. J. Oechsle, Jr. and K. G. LeFevre.
The Iron Age, *180*, No. 2, July 11, 1957, p. 95–98.

323. TESTING

a. *MEASURING THE THICKNESS OF SPRAYED METAL COATINGS.*
R. E. Mansford.
Electroplating and Metal Finishing, *10*, No. 7, July 1957, 208–212.

b. *CORROSION RESEARCH LABORATORIES—12 MINISTRY OF SUPPLY OUTDOOR EXPOSURE STATION, GLASCOED, WALES TESTING PAINTS BY OUTDOOR EXPOSURE—PART 2.*
C. R. Edwards and E. Jenkins.
Corrosion Technology, *4*, No. 7, July 1957, p. 245–250.

c. *DENSITY AND POROSITY OF ANODIC COATINGS ON ALUMINUM.*
Ralph B. Mason.
Metal Finishing, 55, No. 8, August 1957, p. 55–57.

324. ULTRASONICS

a. *APPLICATION OF ULTRASONICS IN THE ELECTROPLATING INDUSTRY.*
Dr. T. J. Bulat.
Metal Finishing, 55, No. 8, August 1957, p. 65–67.

Corrosion
1061 M & M Building
1 Main Street
Houston 2, Texas

Corrosion Technology
Leonard Hill Technical Group
Stratford House
9 Eden St.
London, N. W. 1
England

Electroplating and Metal Finishing
85 Udney Park Rd.
Teddington
Middlesex, England

Iron Age
Chestnut and 56th Sts.
Philadelphia 39, Pa.

Metal Finishing
381 Broadway
Westwood, N. J.

Organic Finishing
381 Broadway
Westwood, N. J.

Products Finishing
431 Main St.
Cincinnati, Ohio

PATENT ABSTRACTS

(*Continued from page 1103*)

The corrosion resistance of chromium plated steel articles is improved by immersing in a solution containing 0.1 to 0.15 g/l of hexavalent chromium until a coating of chromium compound is formed thereon.

13 claims.

No. 2,788,297, April 9, 1957—Conductive Coating Insulators—A. Louis, Assignor to M. Coler, Scarsdale, N. Y.

The surface of solid insulators are made conductive by hammering said surfaces with impactors essentially smaller than the article, said impactors carrying on their surfaces a finely ground conductive material.

See also No. 2,788,296 with 8 claims and figure.

12 claims, figure.

No. 2,788,302, April 9, 1957—Nitriding Stop-off—J. Drew, assignor to General Motors Corp., Detroit, Mich.

The stop-off consists of 30–75 per cent tin by volume and 25–70 per cent of a refractory material (50–75 per cent kaolin, not over 5 per cent sodium silicate, rest water). The article is coated with the above where nitriding is not desired and nitrided.

1 claim.

No. 2,788,303, 4/9/57—Soldering Flux—R. Ballard and D. Burch, assignors to Essex Wire Corp.

The composition is given as:

NH_4Cl	0–15%
$(C_2H_4)_3N$	4.5–35%
$SnCl_2$	rest

6 claims.

No. 2,788,317, 4/9/57—Aluminum Process—C. Sonnimo, assignor to Koenig and Pope, St. Louis, Mo.

Flexible, corrosion resistant anodic coatings are obtained on aluminum in a chromic acid bath containing trivalent chromium ions (less than 5 per cent of total chromium) and at least two compounds selected from tin, zinc, magnesium, aluminum, iron, beryllium, zirconium or titanium dichromate. The bath is substantially free of combined and free sulfuric acid.

14 claims.

No. 2,788,616, 4/9/57—Cleaning Plant—H. Schultz and A. Berninger, assignors to Chemische Fabrik Budenheim, A. Budenheim, Germany.

The apparatus for descaling wire and metal strip consists of a plurality of cleaning rollers of textile material between which the wire passes. The rollers are interconnected so they rotate at different speeds.

8 claims, 5 figures.

No. 2,789,569, 4/23/57—Plating Machine—John Davis, assignor to The Udylite Corporation, Detroit, Mich.

A straight line plating conveyor permitting selective, automatic removal of work pieces (racks) is described.

29 claims, 31 figures.

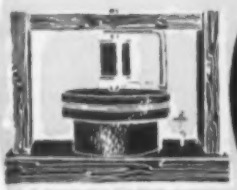
No. 2,789,943, 4/23/57—Production of Titanium—W. Kittelberger, assignor to New Jersey Zinc Co., N. Y.

The improvement consists of inserting a conductive perforate structure between anode and cathode and making this structure cathodic as well as the cathode until the diaphragm has the right degree of permeability, then controlling the current flow between the anode, the titanium bearing diaphragm and the cathode so as to effect deposition of titanium from the fused salt bath on the cathode while substantially maintaining the porous metallic deposit on the perforate structure.

4 claims, figure.

Famous FIRSTS

The FIRST ELECTRIC LIGHT BULB by Thomas Edison



The FIRST TELEPHONE by Alexander Graham Bell

The FIRST AIRPLANE by the Wright Brothers

The FIRST BIAS SISAL BUFF by the JOE-D BUFF CO.

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PERSONALS

Weekly

Kish

Claude E. Weekly has been picked to head MacDermid Pacific Incorporated, the new West Coast division of MacDermid Incorporated, Waterbury, Connecticut and Detroit, Michigan manufacturer of metal cleaning, plating and finishing chemicals.

Complete manufacturing, warehousing, sales and service facilities are now in operation at its headquarters temporarily located at 18802 Fonthill, Torrance, California.

Mr. Weekly has been active in all phases of cleaning, plating and finishing metals for twenty years. At various times in his career he has been a foreman, finishing room supervisor, metal finishing consultant and service manager. He is a charter member and past-president of the Indianapolis Branch, AES.

Charles B. Kish has been appointed chief engineer of the Rectifier Division, Sel-Rex Corporation, Nutley, N. J.

A graduate of M. I. T., with a Master's degree in Electrical Engineering, power option specialist, Mr. Kish has published several definitive articles on high voltage equipment. Prior to joining Sel-Rex in 1952, he had been plant utilities engineer with Inland Manufacturing Division of General Motors for five years.

William F. Cahill is Allied Research Products' new distributor for Maine, New Hampshire, Vermont, Rhode Island and Massachusetts from headquarters at Providence, R. I. The Cahill organization has been distributing chemicals to the metal finishing industry for many years.

Roger Fenwick has been transferred to Cleveland from which he will cover Western Pennsylvania and Northeastern Ohio. Mr. Fenwick has been with Allied for five years.

Robert S. Sweeney, formerly with the Diversey Corp., will cover Central Michigan and Northwestern Ohio from headquarters at Allied's Detroit District Sales Office.

Chester J. Bogin will cover Northern Chicago as well as the Northern Illinois counties including Rockford. Mr. Bogin, formerly a sales representative for the Great Lakes Plating Company and Elkwood Plating Company, will make his headquarters at the Chicago District Office.

Allied Research Products, Inc., of Baltimore manufactures the Iridite line of chromate conversion coatings and ARP plating chemicals.

Frank N. Capparelli will cover Illinois for the Chicago Rubber Co. from headquarters at 15 S. Austin Blvd., Chicago 44. James A. Belanger, 15620 Meadowood, Royal Oak, Michigan, becomes Michigan representative for the firm.

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Baker

Carlson

Noble E. Baker has been appointed as the Central Ohio sales representative for Frederic B. Stevens, Inc., Metal Finishing Division.

For the past two years, Mr. Baker has been with Stevens as an equipment service engineer operating from the Springfield, Ohio plant.

Prior to joining Stevens, he was a technical foreman at Steel Products Engineering Company, Springfield, Ohio, for five years.

Edward L. Carlson, advertising manager of Oakite Products, Inc., has been placed in overall charge of the company's informational efforts in the industrial cleaning and metal finishing fields.

Mr. Carlson, who joined Oakite in 1924, was promoted to advertising manager in 1947. In his new capacity he will supervise the company's activities in industrial trade shows and special promotions, as well as trade paper advertising, direct mail, literature and publicity.

James R. Schaffner has been participating in an intensive research program to more thoroughly qualify himself as a sales asset for the Schaffner Manufacturing Co., Incorporated. Upon the completion of his research program, Mr. Schaffner will be working in sales, under the direction of Paul E. Schaffner, in conjunction with the present expansion program of the Schaffner metal center aircooled (bias type) buffs and buffing composition lines.

David H. Tuel is Wyandotte's new Industrial representative in the Pacific Northwest. Mr. Tuel will headquarter in the Wyandotte Chemicals Seattle, Washington, district sales office. Both Mr. Tuel's educational background and business experience have been chemical—largely in the metal processing industries.

D. A. Golby and **J. E. Lewis** have been assigned to the South Central Region

STUTZ

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1—6000/3000 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS,** Synch.
2—5000/2500 AMPERE, 9/18 VOLT, **CHANDEYSSON,** Synchronous. Exciter-in-head.
1—4000/2000 AMPERE, 6/12 VOLT, **H-VW-M,** Synch., Exc.-in-head.
4—3000/1500 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Exciter-in-head.
1—2000/1000 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING.**
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PERSONALS

Office of Parker Rust Proof Co., with headquarters in Cleveland. Mr. Golby will live in Pittsburgh and cover accounts in that area. Mr. Lewis will cover accounts in northern and central Ohio.

W. N. Jones has been transferred from Parker's research and development department to the sales department, where he has been assigned to the Cold Forming Division. He will be operating out of the Detroit Office.

Samuel Alsop has been named president of the Alsop Engineering Corp., Milldale, Connecticut manufacturers of all types of liquid processing equipment. Mr. Alsop has been executive vice president since 1949 and has functioned primarily in engineering and sales in that capacity.

Van R. Halsey and **I. J. Mack** have been elected to the board of directors of Hanson-Van Winkle-Munning Co.

Mr. Halsey is a partner of Carlisle & Jacquelin, members of the New York Stock Exchange. He is a graduate of Princeton University, class of 1918, and served with the Office of Strategic Services during World War II.

I. J. Mack is vice president in charge of the AGA Division of the Elastic Stop Nut Corp. of America, Elizabeth, N. J. He is a member of the Society of Automotive Engineers and the Institute of Traffic Engineers and serves on board of Youth Consultation Service of Newark, N. J.

Samuel A. Glueck, former general manager of the Eastern Department of Federated Metals Division, American Smelting and Refining Company, has been named general manager of the Midwestern Department. **Louis D. Alpert,** manager of Federated's Los Angeles plant has been appointed general manager of the Eastern Department.

Mr. Glueck, who will make his headquarters at the Whiting, Indiana, plant, has been with Federated since 1933. In 1952, he became general manager of the Eastern Department, which includes Perth Amboy, Newark and Pittsburgh operations.

Mr. Alpert joined Federated as a research chemist in 1935. He has been manager of the Los Angeles plant since 1952.

Edward E. Slowter has been elected vice president of Battelle Institute. A member of the Institute's technical and executive staff since 1936, Mr. Slowter has been the foundation's secretary and business manager.

A professional chemical engineer with BS, MS. and professional engineering degrees from The Ohio State University, he is the author of several major research papers. He has been a contributor, also, to regional and national symposia and conferences on research and research laboratory management.

Herbert J. Niemann has been named sales engineer of Pangborn Corporation, Hagerstown, Md.

Mr. Niemann, formerly associated with the Hydro-Blast Corp. as vice president of sales and executive vice president, will specialize in the application of separate dust collectors in the Chicago area. He is a graduate of Lane Technical School and attended Armour Institute.

T. C. Bierdeman has been appointed district manager of the Wisconsin and Illinois territory for Klem Chemicals, Inc. of Dearborn, Mich.

Mr. Bierdeman has had several years of experience in the industrial metal cleaning field.

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Frederick P. Boehm has been made manager, Pittsburgh sales branch, Solvay Process Division, Allied Chemical & Dye Corp. He will supervise Solvay's sales activities in western Pennsylvania and West Virginia.

Mr. Boehm first joined Solvay in 1940 shortly after receiving his degree in chemistry from Texas Western College. Assigned to the technical service department, he was subsequently named manager of Solvay's ammonium and potassium products section.

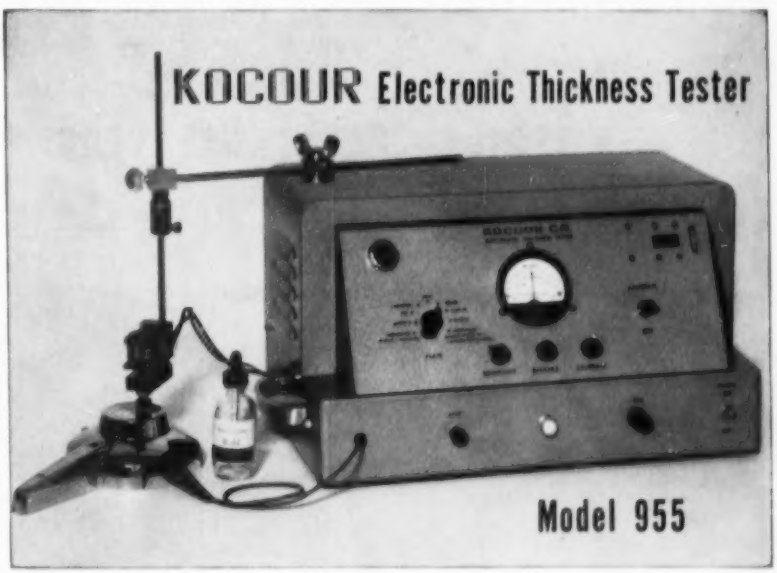
Dr. Clifford A. Neros has been named group leader in the Product Development Section of the Central Research Department of Diamond Alkali Co., Painesville, Ohio. He will continue to direct laboratory work relating to product evaluation and applications research on new chemicals and plastics.

A. Robert Tefft, formerly active in the metal finishing industry of the Providence, R. I., area and more recently technical service chemist in the laboratories of Enthone, Inc., New Haven, Conn., a subsidiary of American Smelting & Refining Co., has been named resident service engineer for Enthone in the Midwest. Mr. Tefft will supplement the service previously given by Robert Goodsell and will have his headquarters at the offices and laboratory of Ardco, Inc., Chicago. **Robert Goodsell,** formerly Enthone resident service engineer for the Midwest, becomes senior resident engineer of the same area. Mr. Goodsell will continue to have his headquarters at Ardco, Inc., Chicago. **A. Harry Sanders,** Enthone sales and service engineer for eastern and northern Connecticut and the Springfield-Holyoke area, has been appointed district manager for this same area. **Frank A. Schneiders** will assist Mr. Sanders. He has been with Enthone since 1950 as technical service engineer. During 1954 and 1955, he served in the U. S. Army as chemical engineering assistant in the Paint and Chemical Laboratory at Aberdeen, Maryland. Mr. Schneiders is a graduate chemical engineer from Lehigh University, a registered professional engineer in Connecticut and an active member of AES and ACS.

Avery Smith has been named assistant to the general manager of Comco, Inc. division of Enthone, J. J. Martin Jr. Mr. Smith will assist in the preparation of proposals for plating room equipment such as plating tanks, barrels, plating racks, polyvinyl chloride exhaust systems and fabrications and will fulfill liaison functions. Mr. Smith was formerly associated with the engineering department of American Machine and Foundry Corp., Deep River, Conn.

J. F. Buckman, former executive vice-president, and one of the original founders of Enthone, Inc., New Haven, Conn., retired from active service. **Edward F. Foley, Jr.,** formerly research chemist, has been appointed production manager and purchasing agent for the manufacturing facility at New Haven. **Lawrence J. Durney,** formerly research chemist, has been appointed manager of Product Development. Mr. Durney will be responsible for the development of products for special problems constantly occurring in the metal finishing field. **William K. Murray,** technical service engineer, has been appointed manager of technical service. **Albert J. Kolb** and **Gordon G. Menzies,** formerly Sr. Lab Technicians at Pratt & Whitney, Div. United Aircraft Corp., have joined the technical service staff. **Miss Harriett Ciaburro** has become control chemist in the technical service laboratory where she will analyze and control plating solution samples.

D. W. Oakley, previously technical advisor to the president of Metal & Thermit Corp., has been made production manager. Mr. Oakley has been with Metal & Thermit since 1947 and from 1952 to 1956 was manager of its Carteret, N. J. plant. **H. A. Rack,** who was production manager has been appointed manager of engineering. He has been with the company since 1944. **C. H. Carpenter Jr.** has been appointed technical advisor to the president. Mr. Carpenter joined Metal & Thermit in 1955 as assistant manager of market development. **K. E. Doud** has been made assistant manager of engineering. **R. E. Davis** has been transferred from the company's central engineering department to its market development division.



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Cleanability and Oil Spreading Rates—By H. B. Linford & P. E. Grubb — *Serial 35, Project 12, 50 Cents*

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Effect of Surface Finishing of Nonferrous Base Metals on Protective Value of Plated Coatings—By G. J. Kahan, W. W. Macchia, J. M. Fairbank — *Serial 31, Project 4, 45 Cents*

Porosity of Electrodeposited Metals—By N. Thon, D. G. Kelemen, L. Yang, S. Yang, D. Dean — *Serial 28, Project 6, 85 Cents*

Effect of Impurities and Purification of Electro-Plating Solutions, VII & VIII—By D. T. Ewing, J. K. Werner, A. A. Brouwer, C. J. Owen and W. O. Dow — *Serial 32, Project 5, $1.00*

The Analysis of Electroplating Solutions for Major Constituents—By E. J. Serfass & M. H. Perry — *Serial 29, Project 2, 90 Cents*

How the Small Electroplater Can Treat Cyanide Plating Waste Solutions with Hypochlorites—By Barnett F. Dodge and Walter Zabban, Yale University, New Haven, Connecticut — *Serial 33, Project 10, 50 Cents*

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UPA

BRANCH NEWS

Total AES Branches U. S., Canada, Australia, September 1, 1957—56.

DETROIT

Stag Outing; Plating Course Starts

The Detroit Branch of the AES had numerous summer activities, such as the annual Stag Day outing, held at the Glen Oaks Country Club on July 27. In spite of the 90° temperature, approximately 1200 members and their guests enjoyed themselves with an excellent program headed by **John F. Siefen,** Stag Day Chairman. His committee consisted of the following members: **John Hitchcock, John Daily, Bob Spaulding, Bill Katke, Wright Wilson, Carl Anderson,** with an advisory committee of **Manuel Ben, Herb Head, Cleve Nixon** and **Walter Pinner.**

Executive Group dinner meeting were conducted by President **Glenn Freidt Jr.** on July 7 and August 1, at the Statler Hotel.

An electroplating course will start on September 17, the first meeting of a 12-week series. The course will provide the necessary scientific background to better understand the reactions and information available on plating processes. This course is being offered by the Detroit Public Schools at the request of the Detroit Branch of the AES. **Fred Brune** is chairman of this program.

A new Detroit Branch Directory was recently released, the first since 1948. This pocket-sized booklet includes our members and their company affiliations, a yearly program schedule listing the particular speakers and their subjects, standing committees and various tables on valuable metal finishing information. The booklet was subsidized by advertisements from vendors represented in this area, without expense to the Detroit Branch. This booklet was established at the suggestion of the Long Range Planning Committee, chaired by Cleve Nixon. The chairman of the Booklet Committee was Manuel Ben, with a committee of the following: **Doug Thomas, Don Bigge,** Cleve Nixon, **John Drinkwater, Ed Kubis, Fred Olmstead, Bert Lewis,** Wright Wilson, **Lee Morse, Jim Mueller, Howard McAleer,** Herb Head, Glenn Freidt Jr. Technical assistance was given by **Al Bohn,** General Motors Research.

The following chairmen were appointed: Bert Lewis as Branch Historian and Bob Amis on Publicity.

The first fall meeting will be held at the Statler Hotel on Friday, September 5. The subject will be "Metal Cleaning Cost and Analysis."

John Drinkwater
Public Relations Director

MELBOURNE

Electrolytic Zinc Proves Interesting Subject

After a showing of films, President **K. Howard,** opened the meeting at 8:20 p.m. There were 65 members and visitors present.

The technical program began with **J. J. Dale** introducing **E. Jones,** of the Electrolytic Zinc Co. Ltd., who lectured on "New Developments at Electrolytic Zinc, Lisdon Tasmania."

Mr. Jones explained in some detail the manufacture of zinc ingots, superphosphate, ammonium sulfate, sulfuric acid, zinc diecasters' alloy, zinc dusts, cobalt sulfate, cadmium, etc., and how these products are won from zinc ore, water and electricity.

An interesting discussion period followed, and a vote of thanks was moved by **H. Merton.**

The president, then introduced Mr. **Spiers,** a representative of an English Metal Finishing Supply House. Mr. Spiers spoke generally on the latest developments in the electroplating industry in the United Kingdom. The main point expressed was the pursuit of bright deposits of all useful metals.

A discussion period followed, and the president thanked Mr. Spiers for his comments. The meeting closed at 10:05 p.m.

P. Major
Secretary

INTERIM MEETING

of the

SUPREME SOCIETY

of the

American Electroplaters' Society

Indianapolis, Indiana

Saturday, January 11, 1958

•

Fuller details in November issue of PLATING

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MISSISSIPPI VALLEY

Organic Division Organized; Gilbert Presented Past President's Pin

The Mississippi Valley branch of the AES, held their July meeting the 17th, at the American Legion in Moline, Illinois.

Nineteen members and visitors were present for dinner, followed by the meeting and movies.

The meeting was called to order by President **"Barney" Nordblom** who called upon Past President **Gilbert** to give an account of the Montreal Convention. Lloyd Gilbert told of being presented with a $50 award in the name of the Branch for the best increase in membership among Branches of our class. He outlined some of the highlights of the convention.

Al Denhart, who also attended the convention, was asked to tell about his activities of the convention. He remarked on the beauty of the city of Montreal.

Lloyd Gilbert was again called forward by the president, "Barney" Nordblom, who presented him with a past president's pin, and expressed appreciation on behalf of himself and fellow members for his endeavors in the past.

A motion was made by **Carl Dunk** and carried that the Educational Session be held April 12, 1958. President Nordblom explained that the speakers' list and meeting place will be announced at a later date.

It was announced by President "Barney" Nordblom that the organizational meeting of the Organic Division of this Branch will be held September 18, at the Moline American Legion Hall.

The speaker for this meeting will be Ezra Blount, who we are sure will present a paper of interest to all concerned.

To authorize the organization of a new Organic Division within our Branch, the following addition to the bylaws was proposed:

Article III-Section 8.

It is hereby established that within this Branch there shall be two separate divisions for the purpose of furthering the specific interest of our members. One division devoted primarily to Inorganic Finishing and the other to Organic Finishing. A member may enroll in either or both divisions, as he may choose.

John L. Hartman,
Secretary-Treasurer

SOUTHERN TIER

Plating Plant Maintenance

The regular monthly meeting was held August 13, 1957 at the Ah-Wa-ga Hotel, Owego, N. Y. Approximately 14 members at this summer meeting heard reports from several members on their trip to the National Convention in Montreal, Canada. Plans were made for a fall family outing for members and guests on the second Sunday in September. Serving on the committee will be: **D. Bates, A. Andreason, B. Wells** and **B. Rossiter.**

President **Bound** suggested that we as a Branch work on a project which can be written up and submitted to the National Organization. Along with this idea, **M. Rake** stimulated interest in the members by suggesting a project along the lines of plant maintenance in the plating department. Mr. Rake has recently accepted a position to serve on one of the AES National Committees which promotes better public relations. It was suggested and moved that we as a Branch take on project of this nature for 3-4 months, guided by a special committee.

B. Rossiter
Secretary

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BRANCH DIRECTORY CHANGES

BOSTON
Time: Dinner 6:00 P.M.—Meeting 8:00 P.M.

KANSAS CITY
Secretary: Robert L. Garrett
3828 East 9th Street Terr., Kansas City 27, Mo.
Time: 7:00 P.M.

LOUISVILLE
Secretary-Treasurer: Richard G. Marshall
3020 Talisman Road, Louisville 5, Ky.

SAN FRANCISCO
Secretary: Arthur E. Schwartz
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AES Membership Report

ELECTIONS

Allentown-Reading: L. C. Hassel
Los Angeles: W. P. Dugan, E. M. Mills, W. H. Stoddard
San Francisco: C. F. Mattman, M. E. Poulton, C. E. Snelgrove
Southern Tier: K. L. Clark, D. E. Regan, F. A. Smith
Western Ontario: V. T. McCann

REINSTATEMENTS

Adelaide: F. Curtis, D. A. Kranz, K. L. Thompson
Detroit: R. F. Gach, J. I. Vlosnak
Houston: H. Hilt, N. Shipp
Philadelphia: F. Fulforth
San Francisco: F. M. Condrott

TRANSFERS

Detroit: W. McLaughlin from Newark; M. A. Parker to Toledo; S. P. Sax from Member-at-Large
Montreal: Clarence H. Iwen from Chicago
Member-at-Large: Stanley P. Sax to Detroit

RESIGNATIONS

Columbus: W. J. Balzer, R. P. Cassidy, G. C. Mills, D. S. Stoker, W. Reid
Detroit: V. P. Boka, E. J. Hergenroether, F. J. Justice
Los Angeles: Ira Hayes
Montreal: R. S. Jacobs, W. Mitchell
Southeastern: A. J. Christian
Member-at-Large: C. H. Boenig

SUSPENSIONS

Adelaide: R. Ellard, J. Lee, W. Peters, G. Pettit
Columbus: W. Reed, Jr.
Hartford: R. George, J. Goddard, A. Pasquini, S. Sikorski
New York: J. Clavell, H. Kashman, A. Kaye, W. Petrie, A. Schiavo, G. Torney
Philadelphia: C. E. Joseph
Southeastern: M. D. Davis, E. F. Hewes
Member-at-Large: P. L. Aube, W. Griff

DEATHS

Cincinnati: C. L. Lancaster

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May 19-22, 1958—45th AES Annual Convention, Sheraton-Gibson Hotel, Cincinnati, Ohio.

June 14-18, 1959—46th AES Annual Convention, Detroit, Mich.

July 10-14, 1960—47th AES Annual Convention, Hotel Statler, Los Angeles, Calif.

INTERSOCIETY

November 2-8—2nd World Metallurgical Congress. Sponsored by the American Society for Metals, Palmer House and Hotel Sherman, Chicago, Ill.

November 4-8—39th National Metal Exposition and Congress, International Amphitheatre, Chicago, Ill.

November 13-16—National Association of Corrosion Engineers, Miami Section, Key Biscayne Hotel, Key Biscayne, Fla.

December 1-6—American Society of Mechanical Engineers, Annual Meeting, Hotel Statler, New York, N. Y.

January 27-30, 1958—Plant Management and Engineering Show, International Amphitheatre, Chicago, Ill.

January 28-31, 1958—Society of Plastic Engineers, 14th Annual Technical Conference, Sheraton-Cadillac Hotel, Detroit, Mich.

February 10-14, 1958—American Society for Testing Materials, Committee Week, Statler Hotel, St. Louis, Mo.

March 17-21, 1958—National Association of Corrosion Engineers, 14th Annual Conference, Civic Auditorium, San Francisco, Calif.

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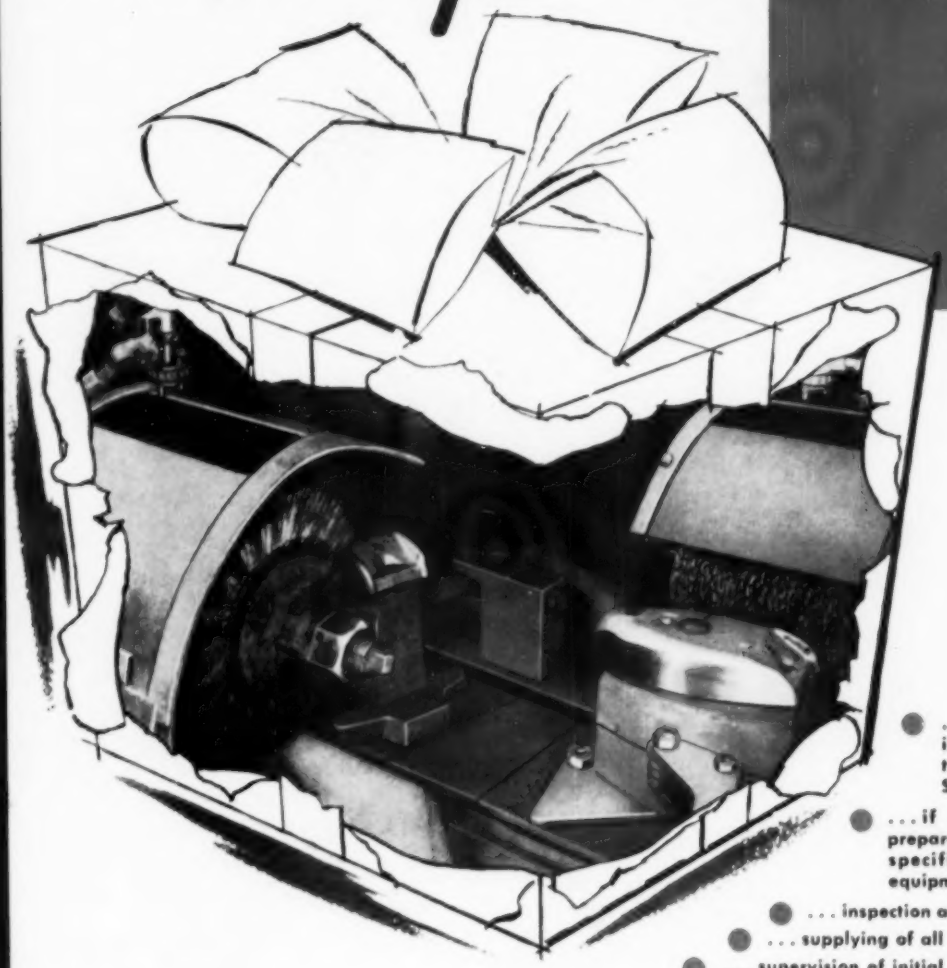

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